A Structured Approach to Entrepreneurial Decision-Making

From Startup Inception to Navigating Uncertainties Using a Developed Typology

Name of student: Apoorva (Study no: 20221401)

Master degree course: M.Sc. Entrepreneurial Business Engineering

Faculty: Entrepreneurial Business Engineering

Course semester: 4

Supervisor: Prof. Yariv Taran

ECTS: 30

Submission: 14.08.2024

Abstract

In today’s volatile, uncertain, complex, and ambiguous environment, entrepreneurs face significant challenges when launching startups. Traditional business methods often fall short of addressing the complexities of such uncertain conditions. Wang et al. (2022) defines a startup as "the practical activity of starting a business in an uncertain environment," where the primary challenge is reducing uncertainty. This study aims to contribute to the field of entrepreneurship by offering a structured approach to decision-making, guiding entrepreneurs from startup inception through the various uncertainties they will encounter. Central to this study is the development of a typology designed to help entrepreneurs select the most appropriate methods based on their business ideas. The proposed typology will be tested and validated through two case studies, demonstrating its practical relevance and applicability. Further scope for research and validation will also be discussed in the end.

Table of content

Introduction

For nearly a century, the interplay between uncertainty and entrepreneurial action has been a focal point of research in the social and human sciences (Knight, 1921). Although uncertainty remains a fundamental element in theories of entrepreneurial action (Packard et al., 2017), its conceptualization in entrepreneurship research is often complex and problematic. Uncertainty presents significant challenges even for the most adept organisational actors. An unpredictable future impedes actors' ability to foresee and understand the consequences of their actions, frequently disrupting the plans of managers and entrepreneurs (Sarasvathy, 2001). Additionally, decision theories in neoclassical economic models are ill-equipped to handle decision-making under uncertainty, making it theoretically difficult to predict outcomes. Consequently, probabilistic reasoning in decision theory is ineffective when dealing with uncertainty (Sarasvathy, 2001).

Despite these challenges, uncertainty is an inherent aspect of entrepreneurship. It drives the entrepreneurial opportunities that are vital for the renewal of organisations and economies. Without human initiative and action amidst irreducible uncertainty, the entrepreneur-opportunity nexus cannot generate value. Townsend et al. (2018) in his paper compared this process to a ship captain steering through uncharted waters in search of treasures. Although the entrepreneurs cannot fully predict what lies ahead, they must make a series of "stepping stone" decisions in the midst of irreducible uncertainty (Townsend et al., 2018)

Given the intricate yet productive role of uncertainty in human affairs, a variety of organisational theories have emerged to address different types of uncertainty as analytical constructs (Townsend et al., 2018). These theories seek to develop decision-making and action models that help entrepreneurs effectively navigate uncertain environments. This research aims to investigate the most widely used entrepreneurial methods and analyse which methods are best suited to different types of business ideas. By identifying the appropriate method for a given business concept, this study seeks to equip entrepreneurs with the tools they need to reduce uncertainty and proceed with greater confidence. The findings of this research will not only assist budding entrepreneurs in selecting the most effective approach for launching their ventures but also provide ongoing support for decision-making throughout

their entrepreneurial journey. The development of a comprehensive typology will serve as a valuable guide, helping entrepreneurs navigate challenges and adapt their strategies as their businesses evolve.

Research Aim

The research aims to determine the most appropriate entrepreneurial methods for starting a new business based on the nature of the business idea and to develop a typology that guides entrepreneurs in making effective decisions to navigate uncertainties throughout their entrepreneurial journey.

Problem Statement

Entrepreneurs often face uncertainty when launching new ventures, especially when selecting the most suitable approach to match their business ideas. This research seeks to address this challenge by analysing popular entrepreneurial methods and developing a comprehensive typology that categorises these methods based on the degree of newness, problem consensus, and solution knowledge. The typology will serve as a decision-making tool to help entrepreneurs effectively manage and overcome uncertainties in their journey from startup to established enterprise.

Research Questions

1. What are the most popular entrepreneurial methods currently used in the process of setting up a business, and which methods are best suited for different types of business ideas?
2. How do the degrees of newness, problem consensus, and solution knowledge interact to influence decision-making strategies for entrepreneurs navigating uncertainty?

Research design

Pictorial representation of this thesis

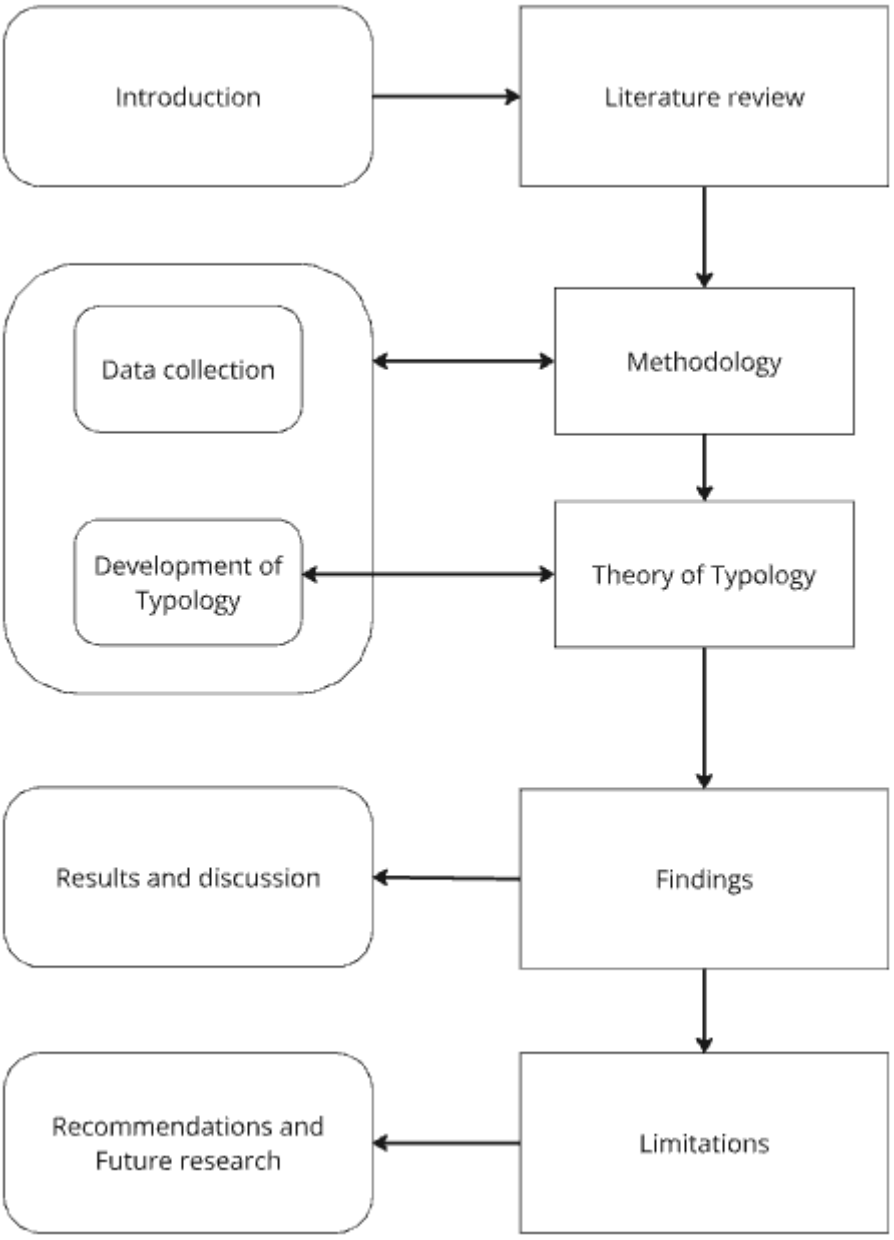


Figure 1: Pictorial representation of research design

Literature Review

The literature review begins by addressing the first research question: “To analyse the most popular entrepreneurial methods and assess their suitability for different types of business ideas based on the nature and characteristics of those ideas.” This section aims to delve into the existing theoretical frameworks on methods for starting an enterprise. It will primarily focus on four widely discussed approaches to entrepreneurship: causation, effectuation, lean startup, and agile methodology. The section will begin with an examination of causation, the traditional method taught in management schools for many years. Following this, it will explore the more contemporary approaches of effectuation, lean startup, and agile methodology. Each method will be analysed to provide a clear understanding of its principles and practices. Additionally, this section will explain which entrepreneurial ideas are best suited to each method and why. Once the initial method for starting the enterprise is established, the discussion will shift to strategies for sustaining the business by effectively managing and mitigating uncertainties based on the degree of newness, problem consensus and solution knowledge.

Choice of Path for a Budding Entrepreneur

The decision-making process of entrepreneurs in the early stages of establishing a business focusing on the overarching uncertainty they encounter is discussed in the section. At the outset, entrepreneurs grapple with fundamental questions: "Should I initiate this business?" and "How should I proceed with its establishment?" The former question addresses the economic viability of the business idea, while the latter delves into the methodological approach the entrepreneur will adopt. The questions "Should I start a business?" and "Should I start this business?" entail distinct forms of uncertainty requiring different modes of assessment. The former involves introspective reflection on personal aspirations and objectives. In contrast, those risks (Packard et al., 2017). The latter necessitates an analytical evaluation of the precise risks and rewards associated with a particular business proposal, as well as the entrepreneur's capacity and readiness to manage

Packard et al. (2017) mentions the risk that an entrepreneur needs to evaluate which is nothing but the uncertainty that they face. Broadly, entrepreneurs have two primary paths

available to them: Effectuation and Causation and then there are two most widely used methods for startups which are lean start-up and agile methodology. Each path represents a distinct strategy for navigating uncertainty in the business startup phase. This section will explore the specific circumstances that lead individuals to choose one entrepreneurial path over another. By examining these factors, the aim is to provide insight into how entrepreneurs evaluate and navigate uncertainty when starting their ventures. This analysis will also offer guidance on selecting the most suitable approach for their unique business ideas.

Causation 

*

Causation is a method of creating a business where thorough market analysis guides the venture. The end goal is clearly defined from the outset, making it a goal-oriented process. All actions are meticulously planned to ensure the achievement of this goal. Such ventures invest significant time in researching the market and gathering essential information to anticipate uncertainties that may arise. They focus on addressing predictable uncertainties. By strategically positioning themselves in the market, these enterprises carve out a niche for themselves within existing market dynamics. Causation is a method to start a business which had gained the maximum popularity in the past few decades and was a very famous topic taught in the business schools. (Sarasvathy, 2001)

This method is employed when the entrepreneur has a clear and precise understanding of the problem they aim to solve and is confident that the solution they are developing aligns perfectly with the needs and expectations of the end users. This approach exemplifies why causation is considered effect-driven rather than goal-driven. In this context, the entrepreneur's decision-making process relies heavily on data and numerical analysis, allowing for strong predictive capabilities regarding future outcomes. However, this reliance on existing data means that the entrepreneur has limited control over entrepreneurial activities. If external conditions were to shift unexpectedly, the entrepreneur would find it challenging to adapt, as the original decisions were based on data available at a specific moment in time. Consequently, while using the causation approach, prediction is considered high, but control over entrepreneurial activities is relatively low.

Effectuation  *

Sarasvathy (2001) says when entrepreneurs begin their ventures, their initial motivations are usually quite broad. These might include goals such as seeking financial success, creating a lasting legacy through building a significant institution or simply exploring an interesting idea that captures their curiosity. In such instances, effectuation can serve as a valuable starting point. Effectuation is a process that begins with a given set of means and focuses on selecting between potential outcomes that can be achieved with those means. This approach is particularly useful when entrepreneurs have a general idea for a business and wish to explore it further before committing significant resources. It's important to note that effectuation is means-driven rather than goal-driven. This means that the entrepreneur doesn't start with a fixed end goal but instead shapes the goal throughout the venture creation process. To understand the effective method Sarasvathy (2001) gives a simple analogy of cooking from the available ingredients in the fridge. There are 2 ways to cook one is when you plan a meal make a list of ingredients and then go shop for it before you prepare a meal (refers to causation) and the other which is very similar to effectual logic is when you just open the fridge and create a new dish with whatever is available in the fridge.

This analogy clarifies a lot about the starting point being means driven, in real life the entrepreneur always starts with three basic questions “Who am I?”, “What do I know” and “Whom do I know”. These are three means by which the entrepreneur starts their journey and in the process of developing the idea they get different stakeholders on board who add their means (Whom they know?) and inputs to enhance the initial idea and develop it further. This way the entrepreneur has great control over the entrepreneurial activity and there is not much left to predict. Effectuation gives an entrepreneur a wide range of effects that can be created by all the available means at hand which implies that the entrepreneur gets the freedom to explore all the possible contingencies along the journey to realising the idea. By doing so there are chances that the enterprise can open up new markets for a specific product which could have been out of the imagination of the entrepreneur in the first place.

This method is typically employed by entrepreneurs who have a strong desire to make a meaningful impact but are initially uncertain about the specific problem they want to solve or the exact direction they should take. In the early stages of their entrepreneurial journey, both

the problem and the path forward may be ambiguous and undefined. However, as they progress and engage with their environment, gather feedback, and explore various possibilities, the direction gradually becomes clearer. Effectuation is characterised by a high degree of control and low prediction. Entrepreneurs using this approach do not rely on forecasting or predefined plans based on existing data. Instead, they focus on leveraging the resources they currently have, such as their skills, networks, and available opportunities, to navigate the uncertain landscape. As a result, they maintain a high level of control over their actions and decisions, adapting and evolving their approach as new information and opportunities arise.

Lean 2*

The lean startup method begins with a hypothesis that is tested through assumptions, customer interviews, product design, and demand validation. The core principle of this method is to avoid wasting resources on products that no one desires. Successful startups excel because they can learn and adapt to customer needs. Instead of rigidly following their initial plan, they adjust based on their findings and ultimately discover a product that customers are willing to buy, scaling it to a large audience. The lean startup approach has demonstrated its effectiveness in building viable early-stage ventures at low cost and high speed. The discipline of the build-measure-learn loop—in which a Minimum Viable Product (MVP) is iteratively developed, tested with real customers, and then either pivoted or continued—provides an exceptionally efficient process for creating sustainable new businesses (Owens et al., 2014).

The lean startup method begins with the inspiration or intuition that customers have a problem that a specific product or service can solve. The product is developed only as much as necessary to conduct the current experiment. The goal is to quickly and affordably create an interaction with potential customers that generates measurable results, leading to learning. Through this process, entrepreneurs accumulate real-world knowledge that informs product development, engineering, and marketing efforts. As product ideas evolve to meet real-world needs, entrepreneurs must ensure they can build a rapidly growing business. The ultimate aim

of these experiments is to achieve product-market fit, where a product delivers enough value to scale quickly to a large customer base. Determining whether a product has achieved this fit is mostly a subjective judgement, with the only definitive proof being exponential business growth. This method relies heavily on prediction while also maintaining a high level of control over entrepreneurial activities. Initially, prediction plays a critical role, as the process begins with an assumption that guides development. As the Minimum Viable Product (MVP) is released to the market, end-user feedback becomes the primary driver for subsequent actions. However, since the methodology emphasizes lean practices at every step, feedback is incorporated only to the extent that it aligns with maintaining a lean approach. Thus, providing high levels of control over entrepreneurial activities as well.

The lean startup approach provides a repeatable process to identify customers, understand their needs, deliver the product, and generate revenue. At its core, the lean startup is about experimentation, applying the scientific method to business. This rigorous procedure for isolating and mitigating uncertainty allows entrepreneurs to learn what they need to launch products and services that resonate with customers, as they have been meticulously designed and tested to ensure their effectiveness (Owens et al., 2014).

Agile  *

By the mid-1990's entrepreneurs faced significant setbacks when early-stage foresight was lacking, as new information or changing conditions necessitated returning to the beginning and redoing each step. In response, the agile software development method emerged as an alternative. Unlike the rigid, upfront specifications of the waterfall method, agile development involves short, iterative cycles that allow for rapid and flexible adaptation to changing conditions. Agile freed programming teams from the sluggish pace of corporate bureaucracy, making it particularly suitable for product development in a networked world where information is exchanged instantaneously. However, similar to the waterfall approach, agile assumes a prior understanding of customers and their problems. (Owens et al., 2014) The agile methodology, increasingly applied to various startup ideas and adopted by organisations, promotes a flexible and responsive approach to business. The author, working at a leading wind turbine manufacturer, observes that teams have embraced agile practices.

Agile methodology falls under low control, as products and services heavily rely on customer feedback, and low prediction, as the solution envisioned at the start can evolve in any direction based on end-user requirements. Entrepreneurs also benefit from opportunities to collaborate with external stakeholders, provided the alliances are profitable and meet customer demands (Sajdak, 2015).

Agility, characterised by the ability to swiftly and adeptly respond to changing markets and customer needs (low control and low prediction due to the volatile nature of customer and market demands), involves producing high-quality products, reducing lead times, and crucially, reconfiguring and mobilising resources (Sajdak, 2015).

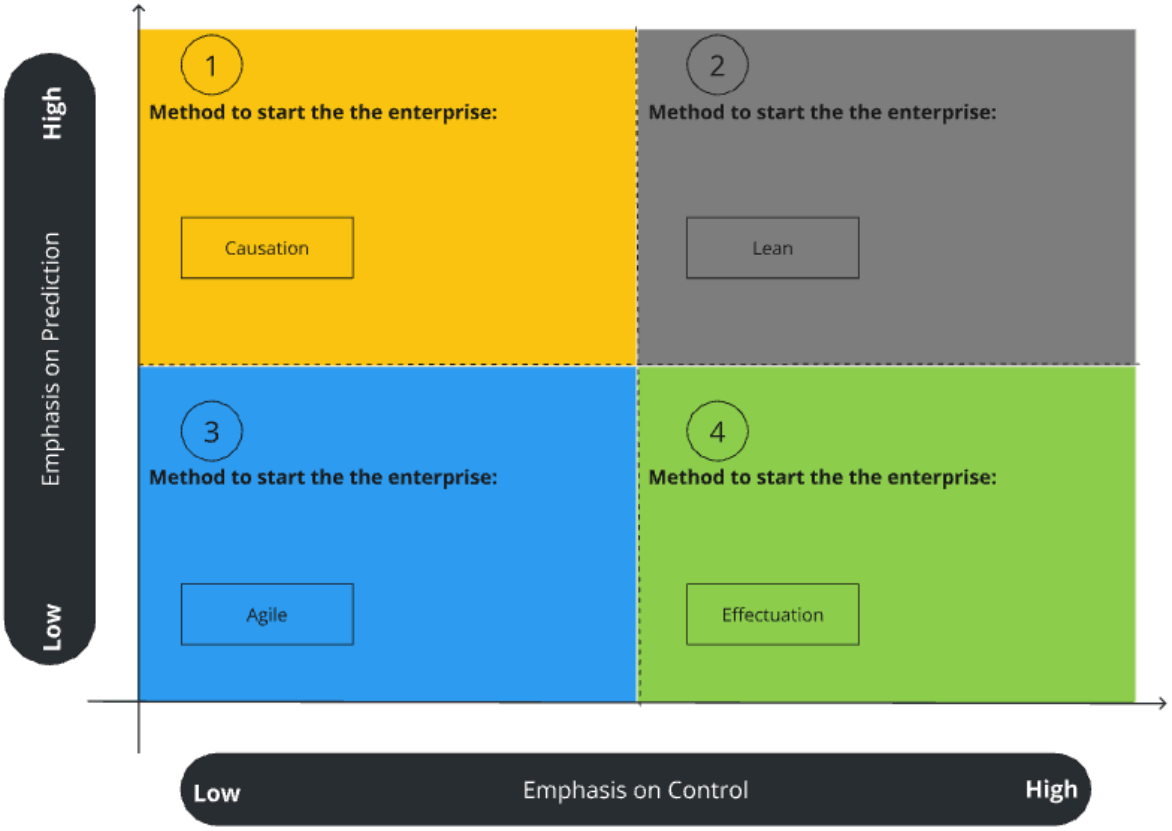


**Figure 2: The matrix showing the control versus the prediction of the four entrepreneurial methods (inspired by, Wiltbank et al., 2006)*

The matrix in Figure 2 will be further developed throughout this study, with the final version discussed in the results section.

Categories of Differentiation	**Causation Processes**	Lean	Agile	**Effectuation Processes**
Givens	Effect is given	The customer has an assumed problem that a product or service can resolve	The customer has a problem but the product or service that will resolve this issue will evolve with the changing needs of the end-user	Only some means or tools are given
Decision-making selection criteria	1. Help choose between means to achieve the given effect 2. Selection criteria based on expected return 3. Effect dependent:	1. Building viable early-stage ventures at low cost and high speed (MVP) 2. Selection criteria based on minimum cost 3. Cost dependent: The choice	1. Building the product in iterative steps ensuring at every stage customer feedback is incorporated 2. Selection criteria based on customer feedback	1. Help choose between possible effects that can be created with given means 2. Selection criteria based on affordable loss or

	Choice of means is driven by characteristics of the effect the decision maker wants to create and knowledge of possible means	of a particular process or usage of a resource is based on cost. The iterative approach is divided into three phases: build, measure, and learn	3. Customer dependent: The choice of addition or removal of a feature is based on customer feedback. The iterative approach is divided into three phases: build, measure, and learn	acceptable risk 3. Actor dependent: Given specific means, the choice of effect is driven by the characteristics of the actor and his or her his or her ability to discover and use contingencies
Competencies employed	Excellent at exploiting knowledge	Excellent for building viable early-stage ventures at low	Excellent for delivering customer-centric products and	Excellent at exploiting contingencies

		cost and high speed	services at high speed	
Context of relevance	1. More ubiquitous in nature 2. More useful in static, linear, and independent environments	1. More ubiquitous in low-budget projects/ventures experimenting with new ideas 2. More useful in fast-paced environments	1. More ubiquitous in technological products/services where the customer needs are constantly evolving 2. More useful in fast-paced environments	1. More ubiquitous in human action 2. Explicit assumption of dynamic, nonlinear, and ecological environments
Nature of unknowns	Focus on the predictable aspects of an uncertain future	Focus on accruing a growing body of real-world knowledge that guides product development, engineering, and marketing efforts at the least cost	Focus on accruing a growing body of real-world knowledge that guides product development, engineering, and marketing efforts	Focus on the controllable aspects of an unpredictable future

Underlying logic	To the extent we can predict the future, we can control it	To avoid wasting resources by making products that no one wants	To ensure customer feedback is incorporated at every iteration	To the extent we can control the future, we do not need to predict it
Outcomes	Market share in existing markets through competitive strategies	To achieve product/ market fit, the point at which an idea delivers enough value that it can scale quickly to a large customer base	To achieve product/ market fit, the point at which an idea delivers enough value that it can scale quickly to a large customer base	New markets created through alliances and other cooperative strategies

Table 1: An overview of the four entrepreneurial methods (inspired by Sarasvathy, 2001)

Table 1 above summarizes the four entrepreneurial methods, outlining the initial conditions for starting a business in each case and the expected outcomes. Figure 2 illustrates the degree of prediction and control associated with each method. These four methods of organising a startup are not an exhaustive list of all possible approaches, but they are among the most widely used by entrepreneurs. It is important to note that effectuation and causation represent two extremes on a spectrum, whereas lean and agile methodologies occupy a space somewhere in between. Effectuation is an approach where entrepreneurs start with their available means and allow goals to emerge over time, while causation involves setting a specific goal and then selecting the means to achieve it. Lean startup and agile methods incorporate elements from both extremes but are distinct in their own ways.

The lean startup methodology is positioned closer to causation because it begins with a hypothesis that a specific problem can be solved with a particular solution, whether a product

or a service. This implies that lean startups do have a predefined effect as a starting point. However, lean startups differ significantly in their approach to organising the enterprise. The lean startup approach emphasises creating a Minimum Viable Product (MVP) and testing it with customers early in the process. This validation occurs well before a detailed Business Model Canvas (BMC) is developed. Despite starting with a specific effect in mind, lean startup methodology is not the same as causation. Lean startups focus on iterative testing and learning from customer feedback to refine their product and business models. This flexibility and responsiveness to customer needs differentiate lean startups from the more rigid goal-oriented approach of causation.

Agile methodology, on the other hand, is positioned closer to effectuation. Although it also begins with an intended effect or hypothesis, the final outcome can significantly differ from the initial assumption due to the continuous incorporation of customer feedback and iterative changes. This process allows the product to evolve dynamically, often deviating from the original hypothesis. This iterative and adaptive nature aligns agile more closely with effectuation, which emphasizes flexibility and emergent goals based on available means and stakeholder inputs. An agile entrepreneur must evaluate the adequacy of its resources and, if necessary, develop key resources internally or acquire them externally. This approach mirrors the "crazy quilt" principle of effectual logic, one of the five principles that underline effectuation. The "crazy quilt" principle emphasizes the importance of forming strategic partnerships and leveraging the knowledge and skills of key business partners to co-create opportunities and enhance capabilities (Sajdak, 2015).

Lean and agile methodologies may appear similar to the layperson, but their underlying ideologies differ significantly. Lean methodology focuses on eliminating waste at every stage of product or service development, ensuring efficiency in all processes. In contrast, while agile also involves an iterative development process centred around customer feedback, it prioritizes the ability to accommodate change over strict waste elimination. Agile refrains from becoming excessively lean if it impedes flexibility and the capacity to adapt quickly to new information or the changing needs of end users (Conboy et al., 2004).

From the above discussion, it is evident that the initial phase of setting up an enterprise is fraught with uncertainty. Entrepreneurs must navigate this uncertainty using different methodologies that align with their vision, resources, and market conditions. Understanding

these methodologies is crucial for entrepreneurs as they decide how to organize their startups. The choice of methodology impacts how they handle the inherent uncertainties of launching a new venture by placing themselves in the PC matrix suggested in Figure 2. By selecting the approach that best aligns with their specific context and objectives, entrepreneurs can better manage risks, allocate resources efficiently, and increase their chances of success.

The use of Table 1 for an entrepreneur will be explained with a couple of examples.

CASE1: Ved

Consider Ved, a novice entrepreneur who has recently graduated from university and has limited real-world market experience. Despite this, Ved is eager to explore a startup idea he has in mind. He wants to develop a software solution to help the university canteen track food wastage. Ved’s friend, an adept coder, is interested in collaborating on this project.

With this information, Ved has the option to use any of the four startup methodologies. Let's examine each method in the context of Ved’s situation. Ved’s starting point is a clear solution in his mind, referring to Table 1 he could choose any method but effectuation. The software solution is based on the assumption that the university canteen needs such a tool. This means that the effect is an assumption but the means are clear and available —Ved's friend knows how to code and is willing to collaborate. This would place Ved in cell 2 of Figure 2. Cell 2 aligns with the lean startup methodology. Given Ved’s amateur status, it is crucial for him to validate his idea and the need for the solution he wants to work on before investing significant time and money. While one might argue that Ved could adopt the agile methodology due to the collaborative element (his friend), it does not fit well with the low control and low prediction. Ved in this case has complete control over his entrepreneurial activity and the initial idea is also based on prediction, implying high degree of prediction and control. Therefore, the lean methodology is the most suitable approach for Ved.

CASE2: Abhay

Consider Abhay, an experienced Environmental Health and Safety (EHS) officer with a high-paying position in a well-established company. Alongside his professional role, Abhay aspires to start a side business that aligns with his passion for eco-friendly initiatives. Over

the years, he has actively volunteered for social events and provided consulting services to small NGOs on EHS principles. With two decades of experience, Abhay has built a robust network of colleagues and industry contacts.

Abhay can choose one of two paths based on his personal choice.

In the first scenario, Abhay embodies the principles of effectuation. Rather than starting with a fixed direction or a clearly defined end goal, he can engage in conversations and gather insights from potential stakeholders. By understanding what others are willing to invest in or support, he can shape and build his venture organically, allowing the final direction to emerge through the resources and commitments he gathers along the way.

Alternatively, if Abhay has specialized expertise in the EHS field and intends to launch a spin-off business (similar to Siddhart, an entrepreneur mentioned in interviews). Here, both the end effect and means are well-established. Abhay can gather all necessary market and customer information to accurately forecast needs(high prediction). Since all his entrepreneurial acrions will be based on these predictions it would mean low control thus this represents a case of causation. Which would imply that he falls in cell 1 if Figure 2 with high prediction and low control.

When selecting a startup method using Table 1 and Figure 2, it is crucial to consider: the starting point and desired outcome. By addressing these considerations, an entrepreneur can determine their position within the four quadrants of Figure 2 and choose an appropriate methodology for their startup endeavour. Once the methodology is clarified, Figure 2 can serve as a valuable tool in helping entrepreneurs understand their position within the prediction and control space. By identifying which quadrant they stand in, they can better determine the appropriate balance of control and prediction in their approach. This understanding will guide them in effectively organizing their venture and aligning their strategies with the specific demands of their chosen methodology which will be discussed in the following sections.

This discussion underscores the crucial initial phase of establishing an enterprise and emphasizes the importance of selecting the appropriate method that aligns with both the idea and the entrepreneur's mindset. The right approach can significantly influence the venture's

success by helping navigate the inherent uncertainties and challenges that come with starting a new business.

The next section delves into understanding various definitions of uncertainty found in the literature. This examination is pivotal as it lays the foundation for developing strategies to mitigate these uncertainties once the enterprise is established. Understanding how uncertainty is characterized across different studies and theoretical frameworks is essential for novice entrepreneurs who face a multitude of unpredictable factors at every stage of their journey. The following section will explore these definitions in detail, providing a comprehensive overview of the various perspectives on uncertainty. By analyzing how uncertainty is defined, the next section aims to create a robust framework that entrepreneurs can use to make informed decisions under uncertain conditions. This framework will serve as a roadmap, guiding entrepreneurs through the complexities of the entrepreneurial process and helping them address the uncertainties they encounter.

Definition and classification of uncertainty

According to the Oxford Dictionary uncertain is defined as *"not able to be relied on; not known or definite.*" whereas uncertainty is defined as *"the state of being uncertain*" or "*something that you cannot be sure about; a situation that makes you not be or feel certain*".

Defining uncertainty is inherently challenging. Scholars have employed various definitions to suit their study objectives, contributing to a vast body of literature on the topic. The concept of uncertainty can be traced back to 1921 when Knight introduced the idea of non-risk uncertainty, distinguishing entrepreneurial phenomena from other events.

According to Knight (1921), a situation is deemed 'uncertain' when it is characterized by (a) the inability to assign objective probabilities to potential outcomes, and (b) the inability to determine the likelihood of events occurring. This concept of uncertainty is particularly relevant to entrepreneurs because business decisions rarely involve calculable probabilities. However, the meaning of uncertainty varies among individuals because it comprises subjective interpretations of events and resources (Packard, 2017). As Milliken (1987) explains, the 'cognitive state' of uncertainty arises from an individual's assessment of the number of alternative predictions for future behaviours or explanations for past behaviours.

Milliken (1987) in his paper states organisational theorists frequently reference three primary definitions:

1. "An inability to assign probabilities to the likelihood of future events (Duncan, 1972; Pennings, 1981; Pennings & Tripathi, 1978; Pfeffer & Salancik, 1978)".
2. "A lack of information about cause-effect relationships (Duncan, 1972; Lawrence & Lorsch, 1967)".
3. "An inability to predict accurately what the outcomes of a decision might be (Downey & Slocum, 1975; Duncan, 1972; Hickson, Hinings, Lee, Schneck, & Pennings, 1971; Schmidt & Cummings, 1976)".

These three definitions form the very basis of all the uncertainty definitions that are developed thereafter.

Milliken categorizes uncertainty into three types: state, effect, and response. State uncertainty pertains to the external environment and an individual's inability to predict the evolution of environmental factors, such as demographic changes, political shifts, and socio-cultural trends. Effect uncertainty involves the inability to foresee how these environmental changes will impact one's activities. Response uncertainty arises when an individual lacks the capability and insight to decide how to respond to environmental changes. Addressing uncertainty requires the ability to judge the use of resources, which underpins entrepreneurial activity and leads to entrepreneurial action (Foss et al., 2019). Entrepreneurs utilize judgment to make decisions and employ resources to achieve their objectives

Despite extensive research, there remains considerable confusion regarding the nature of uncertainty and how best to address it (Townsend et al., 2018). Uncertainty is a complex, multifaceted concept encompassing different levels and types. However, it is often treated as a single entity in academic literature, rather than being analyzed for its various dimensions. Uncertainty can be broadly categorized into internal and external types. Internal uncertainty refers to factors within the entrepreneur's control, such as investment decisions, hiring choices, and the amount of investment. External uncertainty, on the other hand, involves factors beyond the entrepreneur's control, such as government policies, international trade relations, and environmental conditions. For the purpose of this study, the focus will be on the uncertainties that are within an individual's control.

The rationale behind this focus is that if there is control over certain factors, it is possible to develop plans to mitigate these uncertainties. Conversely, uncertainties beyond an individual’s control, like changes in government policies or international trade dynamics, present unique challenges for each situation, making it difficult to devise a common solution. By concentrating on internal uncertainties, the study aims to provide entrepreneurs with practical strategies to manage and reduce these uncertainties effectively. This approach ensures that the findings and recommendations are applicable and actionable for entrepreneurs seeking to navigate the complex landscape of starting and running a business.

From the definitions above the one that suits this study is the “response” uncertainty by Milliken (1987). Response uncertainty refers to the challenge organizations face in understanding the available response options and evaluating their potential outcomes or effectiveness. It arises from a lack of knowledge about what actions can be taken and an

inability to predict the consequences of those actions. This type of uncertainty is particularly relevant when there is an urgent need to act, either due to a perceived threat or a unique opportunity. Response uncertainty aligns closely with how decision theorists define uncertainty, emphasizing the difficulty in knowing the available alternatives, the possible outcomes associated with each, and the value or utility of each option. This uncertainty is most commonly experienced by top-level administrators in an established firm and also very common with entrepreneurs when they must quickly choose between strategies or respond to an immediate external threat. Facing such uncertainties the entrepreneur can play with the prediction and control grid in Figure 2 which was introduced in the last section. The grid helps the entrepreneur to place themselves in one of the four quadrants which helps to organize themselves to face the relevant response uncertainty (Milliken, 1987).

Now that the topic of uncertainty has been addressed, the next step is to explore how an entrepreneur can make decisions when faced with response uncertainty. This involves a thorough examination of the literature on decision-making processes. The aim is to develop a comprehensive roadmap that can assist entrepreneurs in organizing and guiding themselves throughout their entrepreneurial journey.

The following section will delve into an exploration of the literature on entrepreneurial decision-making. The discussion will then shift to the problem consensus and solution knowledge grid, illustrating how this framework can assist entrepreneurs in determining the level of consensus surrounding the challenges they encounter and the potential solutions at their disposal. By synthesizing these insights, a comprehensive understanding of how these elements interconnect will be presented. This synthesis will ultimately lead to the development of a typology, serving as a practical tool for entrepreneurs to make informed decisions, mitigate risks, and improve their likelihood of success.

Entrepreneurial decision-making under uncertainty

Entrepreneurs encounter significant obstacles in the early stages of creating and developing new ventures, such as attracting investors and securing capital, transforming ideas into tangible products or services, validating business models, and scaling their businesses. New ventures inherently operate in risky environments, whether they involve innovative technology-driven models targeting new customer segments or franchise businesses implementing established plans in new locations (McMullen et al., 2006). McMullen et al. (2006) defines the entrepreneur as "someone who specializes in taking responsibility for and making judgmental decisions that affect the location, the form, and the use of goods, resources or institutions" acknowledges the similarity with another definition which describes an entrepreneur as "someone who specializes in taking judgemental decisions about the coordination of scarce resources" and "someone who engages in exchanges for profit; specifically, he or she is someone who exercises business judgment in the face of uncertainty". These definitions collectively portray the entrepreneur as an individual who exercises judgment, a concept that describes as "the components of the larger decision-making process that are concerned with assessing, estimating, and inferring what events will occur and what the decision-maker's evaluative reactions to those outcomes will be".

McMullen et al. (2006) further explains that "decision making" encompasses the entire process of choosing a course of action and defines uncertainty as "the decision-maker's judgments of the propensity for each of the conditioning events to occur". Thus, judgment is essential for making decisions between alternative courses of action in an uncertain future. Although many scholars have emphasized the role of individual judgment under uncertainty in decision-making, it is crucial to recognize that making a decision is a necessary but not sufficient condition for entrepreneurship.

From the fundamental understanding, it is clear that entrepreneurship involves not just making decisions but also acting on them. Entrepreneurial action refers to behaviour stemming from a judgmental decision made under uncertainty about a potential profit opportunity. Whether entrepreneurial action takes place depends on the reliance on one's judgment, which, in turn, hinges on the degree of uncertainty experienced in deciding to act. Various conceptualizations of uncertainty exist in management, economics, and psychology

literature. Notably, Milliken (1987) highlights the term's conceptual inconsistencies within organizational literature and identifies three distinct types of uncertainty: state, effect, and response. Milliken describes state uncertainty as the perception of an unpredictable environment by administrators. Effect uncertainty, on the other hand, refers to "an inability to predict the nature of the impact that a future state of the environment or environmental change will have on the organization". (McMullen et al., 2006).

McMullen et al., 2006 says that Milliken further explains that response uncertainty is “a lack of knowledge of response options and/or an inability to predict the likely consequences of a response choice”. He notes that “response uncertainty is likely to be salient when there is a perceived need to act... because a pending event or change is perceived to pose a threat or to provide some unique opportunity to the organization”. Milliken’s framework suggests that uncertainty in the context of action is primarily about response uncertainty. However, the perceived need to act is often triggered by state or effect uncertainty. This implies that, in the context of action, Milliken’s three types of uncertainty could be simplified into three questions a prospective actor asks about their relationship to the environment: (1) What’s happening out there? (state uncertainty), (2) How will it impact me? (effect uncertainty), and (3) What am I going to do about it? (response uncertainty).

Understanding response uncertainty is crucial, but making a decision alone is not enough; the entrepreneur must also take action to keep the venture alive. This study will focus on response uncertainty and how entrepreneurs decide to act when faced with these uncertainties. The next section will delve into determining the best direction for entrepreneurs to take and the optimal way to navigate that space. When addressing response uncertainty, the key question is, "What am I going to do about it?" To decide whether to act, an entrepreneur must gather data on two additional aspects: what the problem is and how much solution knowledge they have to address it. The following section draws inspiration from management decision-making literature to understand how individuals make decisions under uncertain conditions. This analysis will help clarify how entrepreneurs make decisions when they find themselves in one of the quadrants of the prediction control matrix. From now on in the rest of the thesis when uncertainty is mentioned it refers to the response uncertainty by Milliken (1987).

Murphy et al. (2017) define organizational decision-making as a process of identifying and solving problems, a concept equally applicable to entrepreneurial decision-making. This process comprises two main parts: problem identification and problem solution. During the problem identification stage, the entrepreneur assesses the environment and the venture's condition to determine if performance meets expectations and to identify the root cause of any issues. In the problem-solving stage, potential solutions are examined and evaluated to arrive at a final decision that will guide the venture's future actions.

Entrepreneurial decision-making can be categorized into programmed and non-programmed decisions. Programmed decisions pertain to routine, day-to-day choices that follow established procedures for determining the best solution. These decisions are supported by ample information and past experiences, enabling entrepreneurs to make informed choices. In contrast, non-programmed decisions are typically novel and lack predefined procedures for arriving at a conclusion. In these scenarios, knowledge about the problem and its solution is limited, and the available alternatives may be unclear or ambiguous. This type of decision-making is what entrepreneurs face in uncertain situations.

Sarasvathy (2001) posits that entrepreneurial decision-making can be categorized into two types. The first type, termed bounded rationality, occurs when outcomes are known and measurable, allowing the entrepreneur to select the best possible solution for the venture. The second type, unbounded rationality, arises when outcomes are unknown or immeasurable.

Figure 3: Decision-making in today's environment (Kotter, 1996)

Decision-making in today's business environment is complex, requiring careful consideration of the various factors outlined in Figure 3. Since this study focuses on entrepreneurial decision-making, which often involves a single entrepreneur, this section will concentrate on individual decision-making processes. Individual decision-making can be of two types rational and bounded rational approach. The rational approach is the ideal situation which entrepreneurs should strive to achieve but is practically impossible. This is because the rational approach is a set of methodical steps to define a problem and then work towards a problem solution phase as the decisions which entrepreneurs have to make on a daily basis are mostly non-programmed which implies that entrepreneurial decisions fall under the bounded rational approach. The bounded rational approach is a decision-making process when the entrepreneur is surrounded by the above decision-making environment in Figure 3. This approach is useful for making decisions in uncertain circumstances.

Decision-making within an enterprise consists of two characteristics one being the consensus of the problem at hand that the entrepreneur is trying to solve and the other being the amount of knowledge that the entrepreneur has about that decision under consideration at the time of making the decision. Each quadrant of the matrix by Murphy et al. (2017) will be explained in the following section along with the definition of problem consensus and the degree of knowledge available at the time of decision-making. The decision-making approach is also discussed in each section.

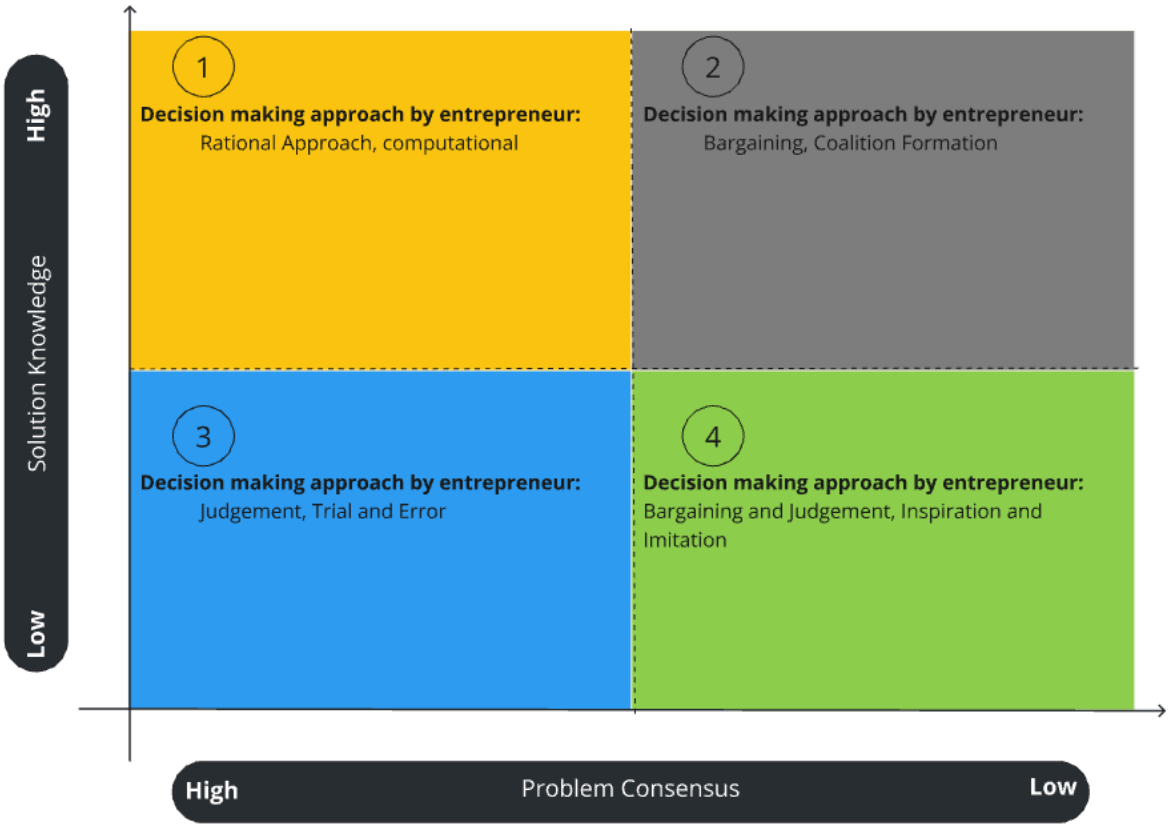


Figure 4: Contingency decision-making framework (Murphy et al., 2017)

Problem consensus refers to the ability to clearly define what the entrepreneur aims to achieve, particularly concerning the degree of newness of an activity to the enterprise. Solution knowledge is the extent to which there is an understanding of how to address the problem at hand. It involves knowing the cause-and-effect relationships of various actions or directions taken to solve the problem. The knowledge of the solution can range from a precise understanding of what needs to be done to complete uncertainty about how to achieve the end goal. When the means are not clearly understood, potential solutions are also poorly defined and uncertain. In such cases, intuition, individual judgement, and cognitive abilities play a crucial role in decision-making. Additionally, trial and error can be employed to arrive at an optimal solution to the problem.

Cell 1: In cell 1 of the above Figure 4, both problem consensus and solution knowledge are certain and well-defined. The cause-and-effect relationships are clearly understood, reducing the level of uncertainty. This implies that decision-making in this scenario can be

straightforward and systematic. A programmed and rational approach can be employed to determine the optimal solution. The final solution can be achieved through analysis and calculations, as all the necessary information is available to the entrepreneur. A clear case of causation as it fits with high prediction and low control.

Cell 2: In cell 2, there is a higher level of uncertainty about problem consensus, whereas the solution knowledge can be easily gathered. This situation arises when the enterprise is faced with multiple problems and is uncertain about which one to prioritise, as focusing on one may mean neglecting or slowing down the resolution of others. In such cases, a calculated decision must be made through discussions and reaching a common agreement on which issue is the most relevant to address at the moment. This corresponds to the lean approach as the issue to focus on in this case is the MVP is made through a common agreement

Cell 3: In cell 3, the problem consensus is clear, but the knowledge of the solution is not. This is a common situation for entrepreneurs. While the problem is well-defined, the resolution is unclear because the cause and effect may not be known to the enterprise, especially when undertaking a new task. The technique to solve the problem is ill-defined and poorly understood. In this scenario, entrepreneurs need to rely on their past experiences, intuitive decisions, and personal judgment to navigate the uncertainty. Here, the entrepreneur's risk appetite becomes crucial. Arriving at a firm solution is challenging since the necessary information for an informed decision is lacking. Therefore, entrepreneurs may adopt an iterative process of trial and error, using continuous efforts and improvements with each failure. Over time, this approach can lead to acquiring sufficient knowledge to make an informed decision. This aligns with agile principles of iterative process to reach a solution.

Cell 4: In cell 4, the situation is characterised by complete VUCA (Volatility, Uncertainty, Complexity, and Ambiguity), meaning both the problem and the knowledge required for its solution are highly uncertain and scarce. In this scenario, entrepreneurs can combine decision-making strategies from cells 2 and 3, such as trial and error, discussions to prioritise which aspects of the problem to address, and intuitive judgment. Additionally, they can employ imitation and inspiration. Imitation involves replicating a sequence of actions taken by another entrepreneur who faced a similar situation, while inspiration involves devising innovative methods to solve the current problem. This space opens up multiple opportunities

as in the case of effectual logic. Since here in this quadrant the problem and solution both are equally unknown this can either be highly opportunistic or on the other extreme of the spectrum can be devastating to the enterprise.

"The fact that environmental changes are predictable does not mean that their consequences are understood. In fact, the more predictable an event or change is perceived to be, the more likely it may be to increase the salience of the effect and response types of uncertainty." (Milliken, 1987)

Moving on another 2 by 2 matrix proposed by Wiltbank et al., 2006 will be examined. In their paper where they have positioned more than 150 literatures around uncertainty along the prediction and control axis as shown below. Nearly all the literature has a mention of prediction and control either explicitly or implicitly.

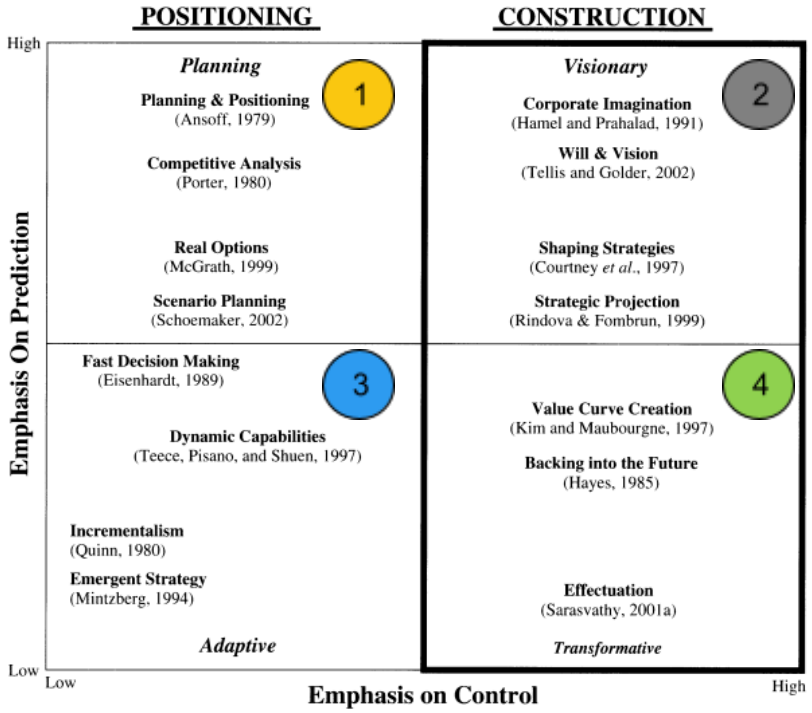


Figure 5: Representative literature on specific approaches to situational control (Wiltbank et al., 2006)

The figure above presents our framework and identifies four main approaches for strategic managers but in this study we will consider the manager as an entrepreneur:

1. Entrepreneurs can assume that the environment is beyond their control but predictable. They can invest in predictive techniques to position themselves advantageously for the future. Wiltbank et al. (2006) refer to this as planning strategies. This is something that fits perfectly with a casual method to start a business.
2. Entrepreneurs can assume the environment is predictable but malleable, and impose their vision of the future, shaping the environment to achieve their desired outcomes. Wiltbank et al. (2006) call these visionary strategies. In this space lean would fit the best
3. Entrepreneurs can assume the environment is unpredictable, shorten their planning horizons, and invest in flexible strategies to respond effectively to changes (agility). Wiltbank et al. (2006) refer to these as adaptive strategies. This space spells out an agile startup method.
4. Entrepreneurs can assume that future environmental factors are largely non-existent and seek to create them through cooperation and goal creation with others to imagine possible futures extending from current means. Wiltbank et al. (2006) refer to these as transformative strategies. This fits very well with the effective logic of the start-up method.

Now combining both the matrixes discussed above this study suggests a 2 by 2 matrix as shown below in Figure 6.

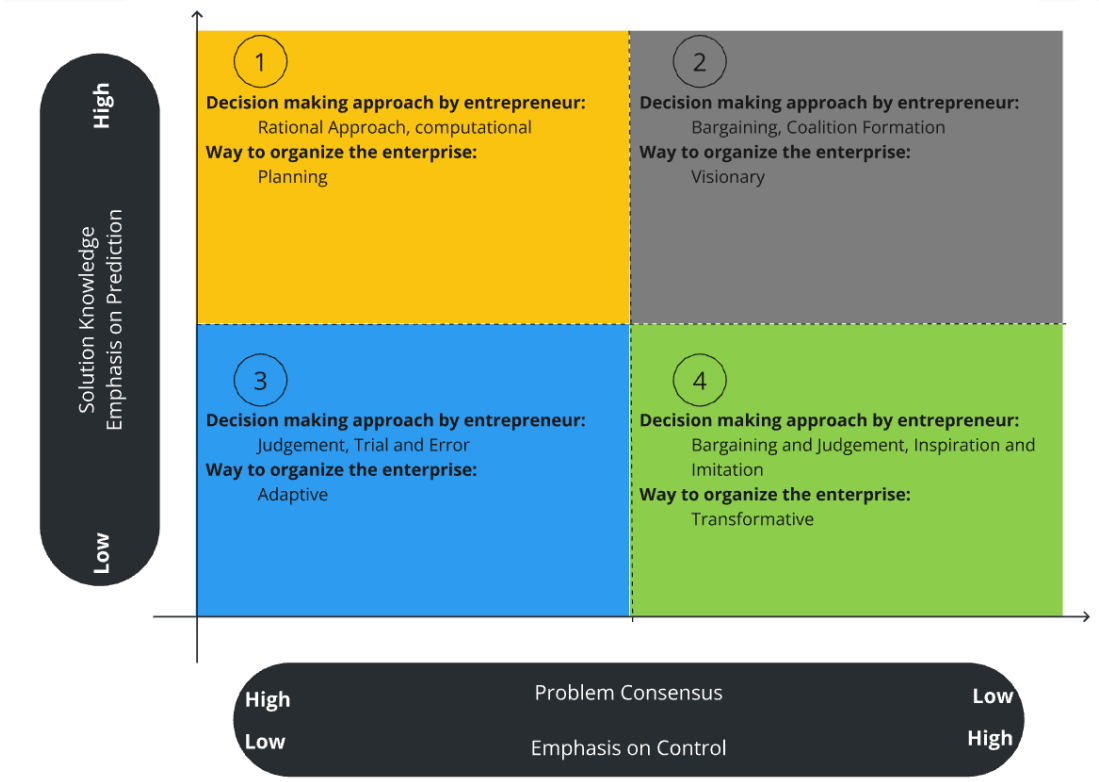


Figure 6: Prediction Control - Problem Solution (PC-PS)# space (inspired by, Wiltbank et al., 2006 and Murphy et al., 2017)

#: Name suggested by the author

With the PC-PS matrix established, the next crucial step is to explore the decision-making strategies that are appropriate for each quadrant. To gain a deeper understanding of these strategies, the following section will examine the approaches to organizing under each condition as proposed by Courtney et al. (1997). This exploration will provide valuable insights into how entrepreneurs can effectively navigate the varying degrees of problem consensus and solution knowledge within each quadrant, thereby aligning their decision-making processes with the specific challenges and opportunities they face. By doing so, this study aims to equip entrepreneurs with the tools needed to make informed and strategic decisions tailored to their unique circumstances.

Strategy under uncertainty (Courtney et al., 1997)

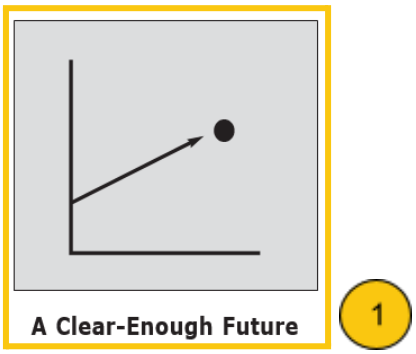
How should an entrepreneur facing significant uncertainty decide whether to take a big risk, hedge their bets, or adopt a wait-and-see approach? Traditional strategic planning processes are often insufficient in such situations. What constitutes an effective strategy in highly uncertain business environments? Some entrepreneurs aim to shape the future through high-stakes decisions. A danger of traditional approaches is that they lead entrepreneurs to view uncertainty in a binary manner—assuming that the world is either certain and open to precise predictions, or completely unpredictable. Planning and capital-budgeting processes that require point forecasts compel managers to conceal underlying uncertainties in their cash flows. These systems push managers to underestimate uncertainty in order to present a compelling case for their strategy.

Making sound strategic decisions under uncertainty requires a different approach that avoids the dangerous binary view of certainty versus complete unpredictability. Entrepreneurs rarely have no strategic knowledge, even in highly uncertain environments (state uncertainty). They can usually identify a range of potential outcomes or specific scenarios. This insight is powerful because the best strategy and the appropriate process to develop it depend crucially on the level of uncertainty a venture faces. The following framework helps determine the level of uncertainty surrounding strategic decisions and tailors strategies accordingly. While no approach can eliminate the challenges of uncertainty, this framework provides practical guidance for making more informed and confident strategic decisions.

Even in the most uncertain business environments, there is a wealth of strategically relevant information. Clear trends, such as market demographics, can help define potential demand for future products or services. Additionally, many factors are currently unknown but can be discovered through proper analysis. For instance, performance attributes of current technologies, demand elasticities for stable product categories, and competitors' capacity expansion plans are often unknown but not entirely unknowable. It can be found that most strategic decision-makers face uncertainty that falls into one of four broad levels.

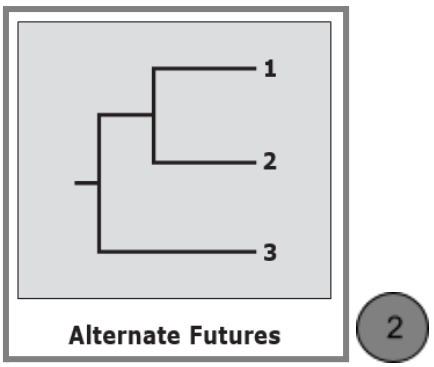
LEVEL 1

Acquiring information to make a particular decision might require new market research but it is fundamentally knowable. Once this information is obtained, the uncertainty would be minimal, allowing the entrepreneur to confidently develop its business strategy. This method is suitable for an entrepreneur employing causation to establish their business, which corresponds to cell 1 in Figure 6. In this scenario, both problem consensus and solution knowledge are well-defined, allowing the entrepreneur to have a clear and structured plan for the future. The causation approach enables precise goal-setting and systematic execution, ensuring that the business progresses towards a clearly envisioned outcome.



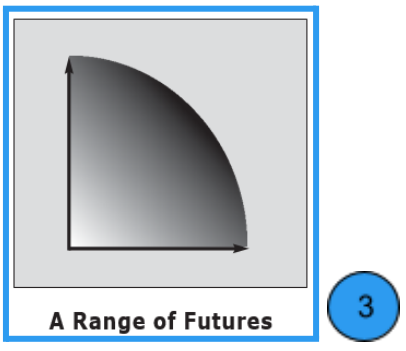
LEVEL 2

Looking ahead, the future could unfold into several distinct scenarios or outcomes. Analysis cannot definitively pinpoint which outcome will materialize, although it can offer insights into their probabilities. Crucially, in such situations, elements of the strategy would likely adjust depending on which specific outcome manifests. This typifies a classic level 2 scenario: where potential outcomes are clearly defined yet unpredictable, and strategy formulation hinges on the eventual outcome. This perfectly aligns with the lean methodology, where the starting point is a hypothesis and the final solution can only be predicted after testing the Minimum Viable Product (MVP). The MVP allows the entrepreneur to gain insights into the needs of end users. Only after the MVP is validated can the final solution be determined. Entrepreneurs employing this approach would fall into cell 2 of Figure 6. The lean methodology emphasizes iterative learning and adaptation, ensuring that the final product meets user needs effectively.



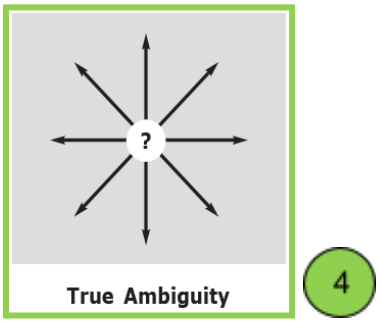
LEVEL 3

In this context, it's possible to delineate a spectrum of potential futures based on a finite set of critical variables, rather than discrete scenarios. The actual outcome could fall anywhere within this spectrum. Similar to level 2 uncertainty, elements of the strategy would adjust depending on the predictability of the outcome. This level entails navigating a spectrum of potential outcomes shaped by identifiable variables, yet without clearly defined discrete scenarios. When using the agile methodology, an entrepreneur can find themselves in a dynamic situation where the outcome is constantly evolving due to continuous feedback loops. The final solution can vary widely, falling anywhere within a range of possible outcomes. In such scenarios, the entrepreneurs will find themselves in cell 3 of Figure 6. It is important to note that while it is not mandatory for the end result to change significantly from the initially proposed solution, it is likely that some changes will occur. This flexibility is a key characteristic of the agile approach, allowing for iterative improvements and adaptations based on real-time feedback.



LEVEL 4

In level 4 uncertainty, multiple layers of uncertainty converge, creating an environment that is exceedingly complex and difficult to foresee. Unlike level 3 scenarios where potential outcomes can be roughly identified, in level 4, even the range of potential outcomes is elusive. It may be challenging to pinpoint or predict all the critical variables that will shape the future. Level 4 situations are ideally suited for the effectual method, where there is minimal understanding of both problem consensus and solution knowledge, this falls in cell 4 of Figure 6. Entrepreneurs in this category start with their available means rather than clear objectives. As they apply the five principles of effectuation, their situation gradually evolves, allowing them to move into one of the more defined levels of uncertainty. This dynamic process helps entrepreneurs make more informed decisions as they progress.



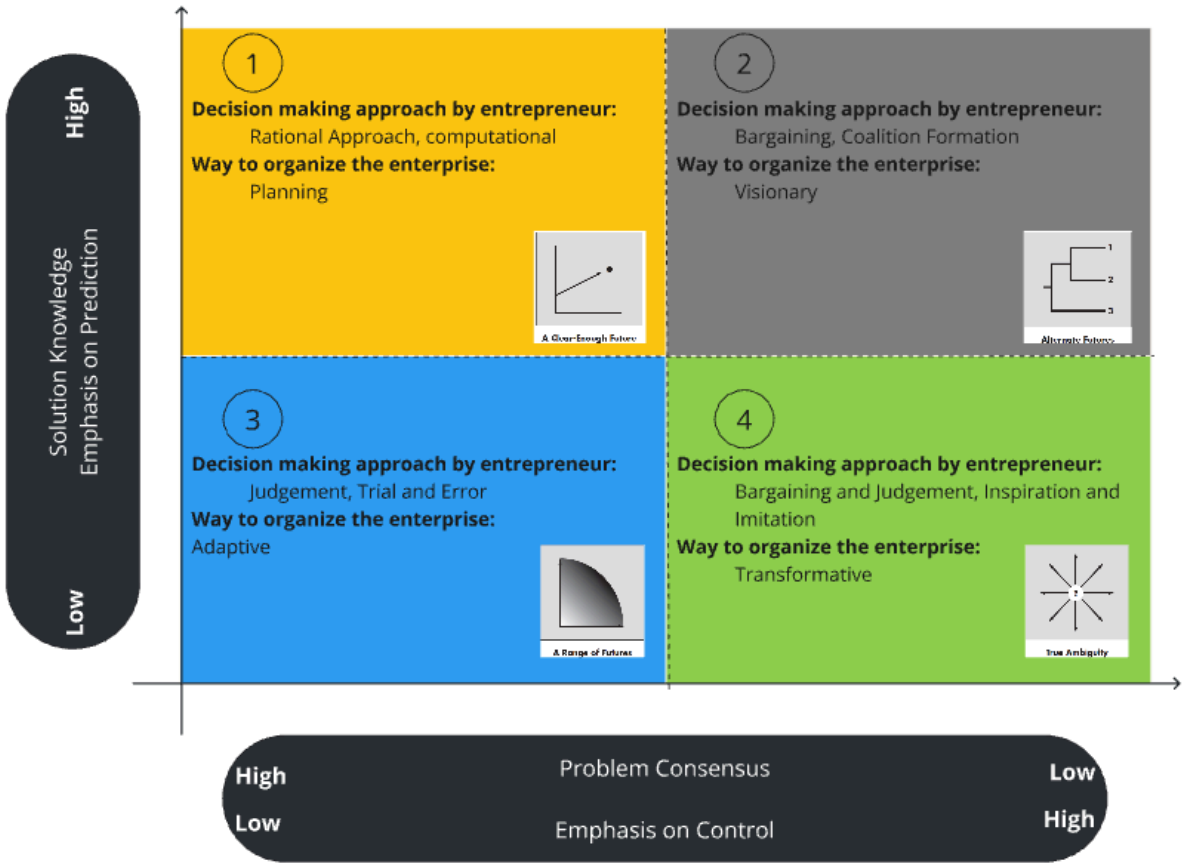


Figure 7: Prediction Control - Problem Solution (PC-PS) space along with the Strategies involved (inspired by, Wiltbank et al., 2006 and Murphy et al., 2017)

Having clarified all aspects of the literature, the next section will delve into the methodology employed in this study. This section will elaborate on the criteria and process for selecting the entrepreneurs for interviews, as well as the steps taken to develop the typology. Following the methodology, a brief discussion on the theoretical underpinnings of typology construction will be presented. This will provide a foundation for understanding the rationale behind the final typology formulation. Subsequently, the final typology itself will be introduced, offering a comprehensive framework for entrepreneurial decision-making under uncertainty. This structured approach aims to provide a clear and methodical pathway from theoretical exploration to practical application in the entrepreneurial context.

Methodology

This research emerged from a comprehensive literature review and analysis of theoretical papers. As a student of Entrepreneurial Business Engineering, the author acquired a broad understanding of various subjects, enabling a higher-level perspective to identify similarities and overlaps among different topics. This broader view inspired the author to step back and consider whether these insights could be used to develop a decision-making roadmap for entrepreneurs facing uncertain circumstances. The initial idea behind this research was to explore the concept of uncertainty as it is presented in the literature and to distinguish between different types of uncertainty. A deep dive into the literature revealed significant confusion and ambiguity surrounding the term "uncertainty." This confusion prompted a thorough analysis to clarify the concept and its implications for entrepreneurial decision-making.

Development of typology

The author set out to develop a typology inspired by the work of Yariv Taran, whose lectures on business model innovation left a lasting impression. Captivated by Taran's approach, the author envisioned creating a typology that categorizes entrepreneurial methods based on three key dimensions: the degree of newness of the activity, problem consensus, and solution knowledge.

The "degree of newness" axis reflects the level of innovation involved in the entrepreneur's planned activity. This dimension is crucial for distinguishing between routine or incremental activities and those that are groundbreaking or disruptive. Taran's discussions on business model innovation, particularly the role of innovation in business success, heavily influenced this axis.

The "problem consensus" axis measures how well the entrepreneur has validated the problem that their proposed activity aims to solve. It emphasizes the importance of understanding and confirming the existence and relevance of the problem before devising a solution. This dimension highlights the entrepreneur's ability to gather and interpret information, ensuring their efforts address a genuine and impactful issue.

The "solution knowledge" axis focuses on the entrepreneur's understanding of how to effectively address the identified problem. It considers the extent to which the entrepreneur has developed or identified potential solutions and their confidence in these solutions. This dimension draws on various theoretical perspectives on problem-solving and decision-making, underscoring the need for a solid grasp of potential solutions to successfully navigate uncertainties.

The integration of these three dimensions into a cohesive typology was influenced by diverse academic sources. The degree of newness concept, for example, was drawn from Taran's work, which highlighted the critical role of innovation in entrepreneurial ventures. The problem-solution matrix provided a foundational framework for understanding the relationship between problem consensus and solution knowledge, guiding the formulation of these axes.

This stage marks the implementation of the first step in formulating the typology, known as the "Identification of Constructs." This critical phase involves thoroughly examining and discussing the unique combination of dimensions that define the ideal types, as outlined by Doty and Glick (1994). A detailed explanation of how these dimensions were carefully selected and considered for this study has been discussed. This process involves identifying the key variables and characteristics essential for understanding and categorizing different entrepreneurial decision-making scenarios.

Data Collection

Participants for the interviews were selected randomly. The rationale behind this approach was to ensure a diverse dataset for testing the typology. Additionally, given that June and July are summer months in Denmark, many potential participants were on vacation, limiting the author's ability to be selective. The entrepreneurs were at various stages of their business development: nascent, growth, and scaling up (between 3 and 8 years old). This diverse range of participants was essential to gain a comprehensive understanding of entrepreneurship in Denmark and to ensure that the typology developed would be broadly applicable.

The author reached out to the entrepreneurs through personal networks to set up interviews both in person and online. A total of nine Danish entrepreneurs were contacted, and five

agreed to participate in the study. Anonymity and confidentiality were assured to all participants to encourage open and honest dialogue. The initial outreach was conducted via email and social media platforms, providing a brief overview of the study's purpose and the importance of their participation.

The interviews were conducted with the following individuals:

1. **Siddharth Bisoi**, Co-Founder of Turnpikes in 2016, a software service provider.
2. **Edin Hajder**, Founder of Plus Consult, Plus Consult specializes in providing innovative coaching and consulting services for startups in Denmark, was established in 2002.
3. **Venugopal** and his friends, Co-founders of Grobasket, an online Asian grocery store, started in 2021.
4. **Peter** and **Bo**, are employees of the large-scale up called Stiesdel, a company specializing in wind turbines with floating bases and other green technologies. Peter had been working with the company for 2 years, while Bo had been with the company for a little over 3 years.

The selection of these participants provided insights from a range of industries and stages of business development, enhancing the study's ability to capture the nuances of entrepreneurial decision-making under uncertainty.

The interviews were conducted using two sets of questionnaires, which are included in the appendix for reference. These questionnaires served as a guide, but the interviews were kept open and informal to gather as many insights as possible from the interviewees. Each interview was divided into two separate sessions, each lasting one hour. During the first session, the initial set of questions focused on understanding how the entrepreneur started their venture, including the reasons and motivations behind it. This part of the interview aimed to gather data to validate the first research question regarding how entrepreneurs decide which method suits their venture idea.

In the second session, the focus shifted to the uncertainties faced by the entrepreneurs during their journey after establishing the enterprise and how they mitigated these uncertainties. This second set of questions was crucial for collecting data to test the typology and validate it through case studies. The interviews were recorded to ensure accuracy, and the author made

notes during the sessions to clarify any doubts immediately. This approach helped minimize personal bias and ensured that the author's understanding aligned with what the interviewees intended to convey.

The interviews revealed that the decision-making process in startups closely followed the individual decision-making patterns mentioned in the relevant literature. This finding enabled the author to connect the dots further and refine the three axes for developing the typology: degree of newness, problem consensus, and solution knowledge. In addition, these interview data helped in validating the typology as the decision-making patterns and the ways of working of these entrepreneurs were in line with the suggested typology. Examples from these interviews are used to validate the typology.

Theory of building a typology

A decision-making roadmap is, indeed, a huge challenge, both theoretically and practically.

According to Christensen (2006), theory development occurs in two major stages:

1. **Descriptive Stage:** This stage involves inductively observing, classifying, and defining various relationships related to a specific phenomenon.
2. **Normative Stage:** In this stage, researchers move beyond merely identifying correlations to defining what causes the outcome of interest.

Building Descriptive Theory: The descriptive stage of theory building is preliminary, as researchers typically need to complete this stage before progressing to normative theory development. To build descriptive theory, researchers follow three key steps: observation, categorization, and association.

Step 1: Observation In the first step, researchers observe phenomena, meticulously describing and measuring their observations. Unless researchers establish a solid foundation through meticulous observation, documentation, and measurement of phenomena in both words and numbers, future researchers will struggle to enhance the theory due to a lack of consensus on the nature of the phenomena. In this stage, researchers often develop constructs—abstractions that help distil and clarify the core nature and functioning of the phenomena, allowing us to

move beyond the complexities of details (Christensen, 2006). The observation aspect is covered in the section above where the constructs of developing the typologies are discussed.

As a student of Entrepreneurial Business Engineering, the author noticed a gap in the practical tools available to entrepreneurs, despite the academic focus on entrepreneurship and decision-making. Entrepreneurs, who invest their own money into their ventures, face significant financial risks, unlike managers in established companies who have the security of organizational support. Managers can make decisions with less personal financial exposure, whereas entrepreneurs risk both their finances and the survival of their businesses.

The author observed that while the literature on uncertainty, decision-making under uncertainty, and methods for starting a business provide useful insights, these topics are often studied separately. This separation can leave entrepreneurs without a clear framework to guide them through the uncertainties of starting and running a business. To address this, the author aimed to integrate these concepts into a model that entrepreneurs can use to navigate uncertainty throughout their entrepreneurial journey. This model is intended to offer practical strategies that entrepreneurs can apply to improve their decision-making and increase their chances of success.

Step 2: Classification - Once the phenomena are described, researchers in the second stage of the theory-building classify these phenomena into distinct categories. During the descriptive stage, these classification schemes are usually based on the attributes of the phenomena. This categorization simplifies and organises the world, highlighting potentially significant relationships between the phenomena and the outcomes of interest. These descriptive classification schemes are commonly known as frameworks or typologies.

Since the author was interested in building a model for entrepreneurs, the framework or typology needed to address three key aspects. First is the degree of newness, which directly correlates to the innovativeness of the entrepreneur's activity. This degree can be low, indicating that the activity is not very innovative, or high, suggesting a highly innovative endeavour. The degree of newness can be high or low for the entrepreneur, the market, or the world. The other two parameters are related to problem consensus and solution knowledge regarding the issues the entrepreneur aims to solve. The literature on problem consensus and solution knowledge has been discussed in detail in the previous sections. These parameters

will guide the course of further action and help to formulate the framework discussed in the later section.

Step 3: Defining Relationships: In the third step, researchers investigate the connections between the category-defining attributes of the phenomena and the observed outcomes. They clarify how variations in these attributes and their magnitudes correlate with patterns in the outcomes of interest. Techniques like regression analysis are often employed to define these correlations in the descriptive theory-building stage. The results of studies at this step are referred to as models (Christensen, 2006). The relation between the parameters to build the framework is discussed in the methodology section.

Taran, et al. (2013) in his paper argue that typologies are complex theoretical constructs that should undergo quantitative modelling and rigorous empirical testing. Taran, et al. (2013) states according to Doty and Glick (1994), for a classification to qualify as a typological theory, three criteria must be met:

1. "Identification of constructs: Typologies consist of ideal types, with each ideal type representing a unique combination of dimensions used to describe the set of ideal types (Doty and Glick, 1994)".

This step was thoroughly addressed in the previous section, specifically within the methodology chapter. There, a detailed explanation was provided on how the constructs for the typology were identified. The process of identifying these constructs was carefully outlined.

2. "Specification of relationships: Typological theories highlight the internal consistency among constructs within an ideal type and explain why this consistent pattern results in the specified level of dependent variable(s) (Doty and Glick, 1994)".

The specific relationships between the constructs—namely, degree of newness, problem consensus, and solution knowledge—are clearly illustrated in Table 3 below.

3. "Falsifiability: Predictions associated with a typology must be testable and subject to disconfirmation (Doty and Glick, 1994)".

The typologies developed in this study are tested using examples drawn from interviews conducted, with the results presented at the end of the following section. While these initial tests offer valuable insights, the typology requires further validation, which presents an opportunity for future research. The potential avenues for such research will be explored and discussed in greater detail in the discussion section. This ongoing exploration will help refine the typology and enhance its applicability in real-world entrepreneurial contexts.

Typology and their definitions

Table 3: Suggested typology

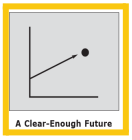
HHH: Wonderer

Activity X is new to the entrepreneur or firm, but the problem it addresses is well-defined, and there is substantial knowledge available to resolve it. In this scenario, both problem clarity and solution certainty are high, placing this activity in Cell 1 of Figure 7.

Example, Givens and Method of organising: The addition of a new business activity within the same geographical area as the parent enterprise, driven by emerging customer demand, represents a scenario where the entrepreneurial method of causation is highly applicable. In this case, both the problem consensus and the solution knowledge are well-defined and clear. The demand from customers has been identified, and the entrepreneur has already devised a concrete action plan to address the issue effectively. This situation aligns with cell 1 of Figure 7, where prediction is high and control is low. The clarity of the problem and the solution enables the entrepreneur to confidently forecast the future outcomes of their actions. Any gaps in information that may exist at the moment can be addressed through targeted research, exploration, and thorough market study, further reinforcing the predictability of the venture's success.

Causation, in this context, allows the entrepreneur to follow a structured, data-driven approach, reducing uncertainty and enabling precise planning and execution. The entrepreneur can move forward with a clear roadmap, relying on established methodologies and strategic planning to achieve the desired outcomes.

Decision-making approach: Rational approach with the help of computation

Strategic outcome: Clear enough future 

HHL: Pathfinder

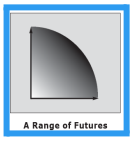
Activity X is new to the entrepreneur or firm, and while the problem it addresses is clear (high problem consensus), the knowledge to resolve it is limited. This means that while the problem certainty is high, the solution knowledge is low, placing this activity in Cell 3 of Figure 7.

Example, Givens and Method of organising: When an enterprise introduces a new business activity within the same geographical area as its parent organization, driven by emerging customer demand, it often faces the challenge of determining the most effective way to manage this new venture, referred to here as "Activity X." Although the demand for Activity X is clear, the exact approach to delivering this new service or product is not yet fully understood. This situation calls for an entrepreneurial method that can adapt to uncertainty and evolve as more information becomes available.

In this context, the agile methodology emerges as the most suitable approach. Agile is particularly effective in scenarios where the problem consensus—understanding what needs to be addressed—is clear, but the knowledge of how to implement a solution remains uncertain. The enterprise must adopt a flexible, iterative process that involves experimenting with different strategies, incorporating customer feedback, and refining its approach until a viable solution is identified that meets the needs and expectations of the end users. This scenario aligns with what is described as Cell 3 in Figure 7, where both prediction and control are low. In such cases, while the future outcomes cannot be precisely predicted, they can be anticipated within a certain range of possibilities. The control over the outcome is also said to be low as there is constant feedback from end users which drives the development of the final outcome. The entrepreneur must, therefore, engage in a process of trial and error, continually adapting to new information and feedback as the project progresses.

The agile methodology allows for the gradual convergence of a solution that is not only feasible but also aligned with customer needs and expectations. The iterative nature of agile ensures that the enterprise remains responsive to changes and can make adjustments as necessary, ultimately leading to a solution that is well-suited to the market demand and operationally viable for the organization.

Decision-making approach: Judgement, trial and error

Strategic outcome: A range of futures 

HLH: Wizard

Activity X is new to the entrepreneur or firm. Although the problem it addresses is unclear (low problem consensus), there is substantial solution knowledge available to solve it. This scenario, where problem certainty is low but solution certainty is high, places Activity X in Cell 2 of Figure 7.

Example, Givens and Method of organising: An enterprise that is exploring the adoption of Artificial Intelligence (AI) technologies into its work processes faces a significant challenge in determining the most suitable aspects of AI to implement (problem consensus). While there is a wealth of data available to program and train AI systems (solution knowledge), the specific functions within the organization that would benefit most from AI integration remain unclear. The organization is in a position where the potential for AI to enhance productivity and efficiency is evident, but the exact applications and areas where AI should be deployed have not been fully identified. Once the organization achieves a clearer understanding of which processes or functions could be effectively augmented by AI, the implementation of these technologies can proceed more smoothly, allowing the enterprise to address and solve the identified problems efficiently.

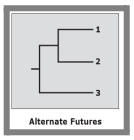
This approach can be effectively executed using the lean methodology, which begins by generating multiple hypotheses and testing them with end users. This idea of generating alternative futures showcases high control and predictability in entrepreneurial activity. The hypothesis that receives the most positive feedback can then be further refined and developed. By taking this iterative approach, the enterprise can establish a clear direction for AI implementation, ensuring that the solutions developed are not only aligned with operational goals but also meet the specific needs of customers. Leveraging existing data resources, the enterprise can fine-tune AI-driven solutions to optimize both efficiency and customer satisfaction. (As expressed by Siddhart in his interview)

In this scenario, adopting the lean methodology is particularly appropriate because it allows for the development of multiple Minimum Viable Products (MVPs), each of which can be tested with end users to gather feedback and identify the most promising solution. Although creating multiple MVPs is not the traditional approach within lean methodology, this strategy

can be effective in the context of software solutions, where iterative testing and rapid prototyping are crucial to refining the product.

If the same situation were applied to the development of a physical product, the approach would need to be slightly modified. While creating multiple MVPs might be less feasible due to the higher costs and longer development times associated with physical goods, a similar iterative approach can still be employed internally within the firm. Here, the entrepreneur and their team (if any) could initially explore two or three different product ideas, which can be discussed amongst themselves to prioritize the final MVP. Once this MVP is selected, it can then be further developed and tested in the market, with subsequent iterations shaped by customer feedback. This approach ensures that even in the context of physical products, the lean methodology's emphasis on learning through doing, minimizing waste, and responding to user feedback is maintained. The key is to remain lean, flexible and adaptive, using data and feedback to guide the development process toward a solution that meets both market demands and business goals.

Decision-making approach: Bargaining, discussions and prioritising

Strategic outcome: Alternative futures 

HLL: Pace-setter

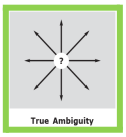
Activity X is new to the entrepreneur or firm, with both the problem being unclear (low problem consensus) and the available solution knowledge to resolve it also low. In this scenario, where both problem and solution uncertainty are high, Activity X falls into Cell 4 of Figure 7.

Example, Givens and Method of organising: Edin's entrepreneurial journey is a textbook example of effectual logic in action. He made the bold decision to leave his high-paying job and venture into the unknown without a predefined business plan or clear objective. At the outset, Edin had no concrete idea of what he wanted to achieve. Instead of beginning with a

specific goal, he embarked on a process of exploration by engaging with people and immersing himself in conversations. Through these interactions, he gradually discovered his passion, which coincidentally aligned with an unmet need in the market. (As expressed by Edin in his interview)

This approach exemplifies effectuation, a method where entrepreneurs start not with a clear destination, but with their available means—such as their skills, knowledge, and networks. As they take small, incremental steps, they gather insights and resources that progressively shape the direction of their venture. In Edin's case, each conversation, observation, and experience contributed to clarifying his business idea, turning what began as uncertainty into a focused entrepreneurial pursuit. Over time, Edin's understanding of the market deepened, and his business concept evolved organically from these initial, seemingly unconnected steps. The effectual approach allowed him to remain flexible and responsive to emerging opportunities, rather than being confined by a rigid plan showcasing that he had a very high control over his entrepreneurial activities keeping the prediction as low as possible. His journey illustrates how goals in effectuation emerge gradually, as a result of ongoing learning and adaptation, rather than being predetermined.

Decision-making approach: Bargaining, judgement, inspiration and imitation

Strategic outcome: True Ambiguity 

LHH: Achiever

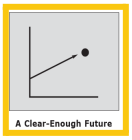
Activity X is familiar to the entrepreneur or firm, with both the problem being well-defined (high problem consensus) and the solution knowledge to resolve it being strong. In this case, where both problem and solution certainty are high, Activity X falls into Cell 1 of Figure 7.

Example, Givens and Method of organising: Addition of a food item to the menu of a food stall. This new dish has been requested by the consumers and the enterprise has enough data to predict that there is a market for the same.

In this scenario, the addition of a new dish to the menu of a food stall represents a well-defined problem, directly identified by consumer demand. The entrepreneur is aware that the absence of this particular dish is the issue to be addressed, and the fact that the demand originates from the customers themselves significantly simplifies the process of gathering data and making informed decisions. This customer-driven demand offers a clear indication of market potential, enabling the entrepreneur to make accurate predictions regarding the dish's impact on the business. The availability of data ensures that any gaps in knowledge can be quickly filled through targeted research and analysis.

In this context, the entrepreneurial situation is characterized by high predictability and low control. The entrepreneur can confidently forecast the future success of the dish based on consumer feedback and market analysis, showcasing that causation is the best method to imply in this case.

Decision-making approach: Rational approach with the help of computation

Strategic outcome: Clear enough future 

LHL: Scout

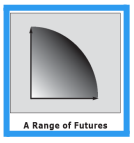
Activity X is familiar to the entrepreneur or firm, and while the problem is clearly defined (high problem consensus), the knowledge to resolve it is limited. This scenario, where problem certainty is high but solution certainty is low, places Activity X in Cell 3 of Figure 7.

Example, Givens and Method of organising: In Stiesdal's hydrogen cells, several issues emerged from the beginning. Significant effort was invested in developing a key component of the product known as the stack, which is located inside the cells where the electrolysis process occurs. Initially, an engineering sample was created, which was a small electrolyser unit intended to test a concept. However, it became apparent that the concept would not work as planned. The original intention was to pressurise the process inside a vessel using the hydrogen being produced, but it quickly became clear that this approach was not feasible. As

a result, a major change was made, and nitrogen was used instead. Additionally, challenges arose with the stack itself. The first sample of the stacks did not meet the expected quality standards and failed in unexpected ways. The initial stack only lasted a few minutes of operation before it became evident that it would not be viable. Consequently, the stack had to be rebuilt, and all the gaskets were replaced with thicker ones. This process involved a considerable amount of trial and error to ultimately reach a workable solution. (As expressed by Peter in his interview)

In this example, it is evident that the problem consensus was clearly identified from the outset. The team recognized early on that the initial approach would not be viable, leading them to intentionally deviate from the original plan. However, while the problem was well understood, the solution was not immediately clear. This uncertainty necessitated the use of simulations and the development of prototypes to explore various alternatives. Through a process of trial and error, the team tested different options to determine the most effective solution. The iterative nature of this process highlights that both control and prediction were relatively low in this context. The complexity of the problem and the uncertainty surrounding potential solutions meant that the final outcome could only be determined by actively experimenting with different solution options. Feedback from the design team, who acted as the end customers in this scenario, played a crucial role in refining the solution. After each test, the designers provided insights into what aspects were successful and what required further improvement. This iterative feedback loop was essential in gradually honing the solution to meet the desired standards.

Decision-making approach: Judgement, trial and error

Strategic outcome: A range of futures 

LLH: Trailblazer

Activity X is familiar to the entrepreneur or firm (low degree of newness), but the problem is unclear (low problem consensus), while the solution knowledge to resolve it is strong. In this

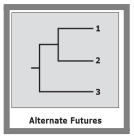
case, where problem certainty is low but solution certainty is high, Activity X falls into Cell 2 of Figure 7.

Example, Givens and Method of organising: Venugopal from GroBasket faced the challenge of adding certain grocery items from India to his inventory, even though he had a reliable and experienced supplier. The main task was figuring out how to import these items in a cost-effective way while complying with all Danish laws and regulations. (As expressed by Venugopal in his interview)

In this scenario, the entrepreneur has a clear understanding of the desired end solution: stocking specific Asian groceries in their store. However, the problem consensus remains unclear, as the entrepreneur lacks detailed knowledge about the logistics and processes involved in importing these items to Denmark cost-effectively and profitably (low problem consensus). The entrepreneur has the advantage of having an established and experienced seller in India who is ready to ship the goods (high solution knowledge). The situation is characterized by high control over entrepreneurial activities, as the entrepreneur has the authority to make key decisions, such as selecting logistics partners and negotiating with sellers in India. This control allows for greater flexibility in navigating potential challenges and adapting strategies as needed. Furthermore, the ability to predict and anticipate potential problems that may arise during the import process is also relatively high. The entrepreneur must foresee possible obstacles, such as customs regulations, shipping delays, and cost fluctuations, and then explore various solutions.

In this context, the entrepreneur would need to prioritize the available options by carefully weighing their pros and cons. The decision-making process would involve selecting the option that is most feasible and aligns with customer demands, and then developing this option further to ensure its success. This approach exemplifies the application of lean methodology in a startup environment, particularly in an industry that differs from the traditional tech-focused domains where lean practices are often applied.

Decision-making approach: Bargaining, discussions and prioritising

Strategic outcome: Alternative futures 

LLL: Utopian

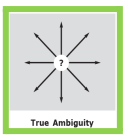
Activity X is not familiar to the entrepreneur or firm (low degree of newness), but both the problem consensus and the solution knowledge to resolve it are also low. In this case, where problem and solution uncertainty is high, Activity X falls into Cell 4 of Figure 7.

Example, Givens and Method of organising: Consider Maya, a skilled chef who recently moved to a new city and is exploring her options for starting a business. Initially, she is uncertain about the direction she wants to take. She is torn between different possibilities: owning a food truck, operating a food cart, working in a restaurant, or freelancing as a chef. To gain clarity, Maya begins discussing her ideas with people in her network. Through these conversations, she discovers that the city council is in need of a well-trained chef to help train others for the upcoming Olympics kitchen.

In this scenario, Maya's expertise as a chef is a known factor (indicating a low degree of newness), but she is unsure of what path to pursue, making both the problem consensus and solution knowledge are low. However, through her interactions, Maya identifies an unexpected opportunity: starting a business centred around training new chefs for the Olympics. This is a clear example of effectuation in action.

By engaging with her network and seeking input from others, she was able to identify a viable business idea that she hadn't initially considered. In effectuation, entrepreneurs like Maya leverage who they are, what they know, and whom they know to co-create opportunities with stakeholders. In this case, by connecting with the city council, Maya secures an important partner, thus building what is known in effectuation theory as the "crazy quilt" of committed stakeholders. Through this process, Maya transitions from uncertainty to a clear and actionable business plan, illustrating how effectuation can guide entrepreneurs in discovering and pursuing opportunities that emerge from their existing resources and networks.

Decision-making approach: Bargaining, judgement, inspiration and imitation

Strategic outcome: True Ambiguity 

Examples from the interviews

Siddharth: Achiever

Siddharth moved to Europe for his undergraduate studies and continued with a master's degree. Shortly after completing his education, he secured his first job as a software developer and has now accumulated 26 years of experience in the IT industry. During his career, Siddharth developed a close and professional relationship with his manager. However, an unexpected situation at work led to the manager being dismissed. In a personal conversation after the event, Siddharth and his former manager discovered they shared a common interest in starting their own business. Both had extensive experience in the industry and had built a strong network of contacts essential for running a successful enterprise. Over the years, they had also developed deep expertise in the specific IT services they intended to offer.

This scenario exemplifies the "Achiever" approach in entrepreneurship, where the degree of newness in the venture is low, and there is a high level of clarity regarding both the problem to be solved and the knowledge required to solve it. Siddharth and his partner, having spent decades in the IT industry, possessed niche expertise in the services they planned to provide. Their approach to setting up the business was rooted in causality, meaning they relied heavily on prediction and data rather than control. From his interview, it was evident that Siddharth preferred a structured, causal approach to entrepreneurship. They meticulously planned every aspect of the business, and as a result, everything proceeded as anticipated. The venture was characterized by low uncertainty and high predictability, with decisions driven by data and careful forecasting rather than flexibility or improvisation.

Edin: Pacesetting

Edin had lived in Denmark for over two decades, working as a project leader in a well-established company. Despite his success, he felt a strong desire to start his own business, driven by a wish to work on his own terms. After discussing his ambitions with his manager, an agreement was reached: Edin would take a one-year sabbatical to experiment with launching his own venture. If successful, he would continue with his business; if not, he had the security of returning to his job.

During his sabbatical, Edin identified a gap in the market by engaging in conversations with friends and colleagues. He didn't start with a clear goal but instead embraced an effectual approach, allowing his path to evolve as opportunities arose. He applied the principle of affordable loss, investing only what he was willing to lose without jeopardizing his financial stability. Edin also utilized the crazy quilt principle, forming partnerships with municipal offices and offering services to entrepreneurs, relying heavily on his personal network for support and advice. Importantly, he maintained sole ownership of his business, choosing to leverage goodwill and relationships rather than formal partnerships.

Edin’s business has now been thriving for over 15 years, providing crucial guidance to new entrepreneurs in Denmark who struggle to secure funding and establish themselves in the market. When he started, there were few advisers offering such services, but the landscape has since become more competitive. Despite this, Edin’s business has remained resilient, a testament to his strategic use of effectual principles and his ability to adapt to the changing entrepreneurial environment.

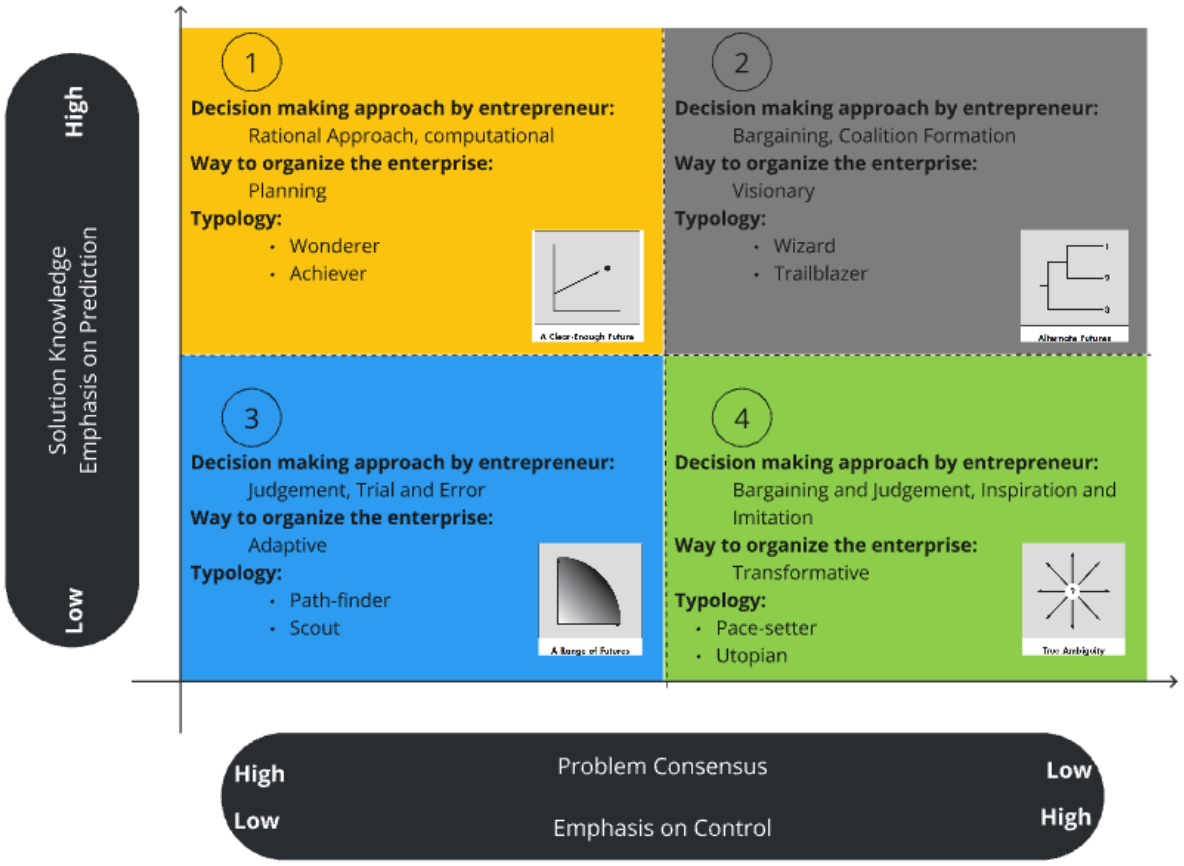


Figure 8: Prediction Control - Problem Solution (PC-PS) space along with the Strategies involved and Topology (inspired by, Wiltbank et al., 2006 and Murphy et al., 2017)

This final matrix, incorporating the developed typology, addresses the second research question: "How do the degrees of newness, problem consensus, and solution knowledge interact to influence decision-making strategies for entrepreneurs navigating uncertainty?" The matrix illustrates the interaction and relationship among the key constructs of the typology. It provides entrepreneurs with a clearer understanding of how these factors interplay, helping them make more informed decisions throughout their entrepreneurial journey.

Results, Discussion Limitations and future scope for research

Result:

The research aim for this study was "*To explore how entrepreneurs can effectively determine the most appropriate method for starting a new business based on the nature of their business idea, develop a comprehensive set of typologies to guide their ventures and formulate decision-making strategies to navigate uncertainties throughout their entrepreneurial journey.*" In the current business environment, entrepreneurs face numerous hurdles when selecting the optimal path for launching their ventures. For novice entrepreneurs, having this comprehensive guide can be highly beneficial in determining which entrepreneurial method best suits their ideas. The first part of this study aimed to formulate such a guide, identifying which approach aligns best with different types of business concepts. The second part of this thesis focused on navigating the challenges that entrepreneurs encounter once their ventures are established. The typology developed in this research serves as a foundational tool for understanding which strategies to apply to achieve optimal results according to established theories. This typology also aids entrepreneurs in comprehending the nature of the problems they need to resolve.

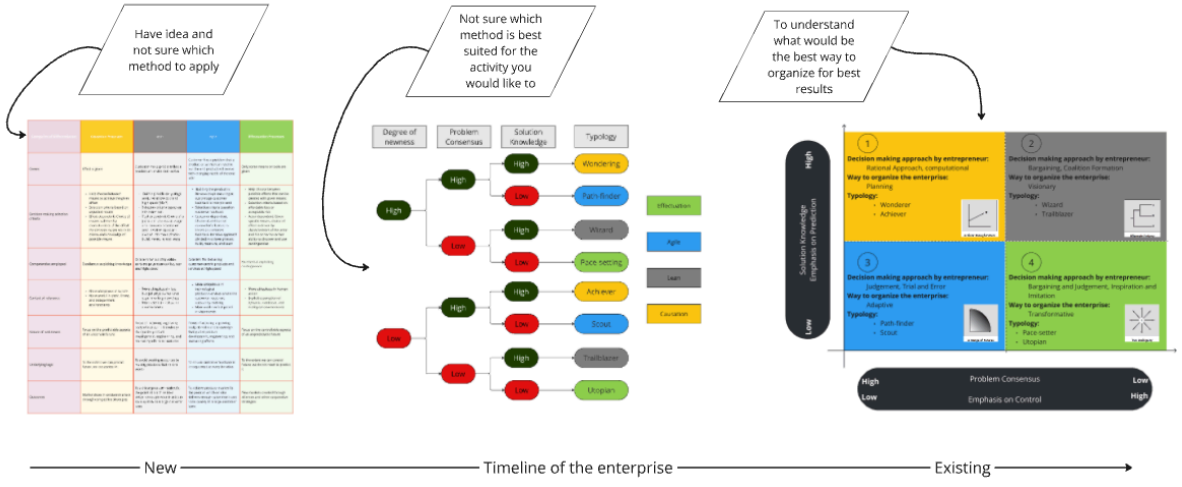


Figure 9: Overall contribution to theory - Application flow of the table and typology developed in this study.

By utilizing this typology, entrepreneurs can significantly reduce the time and resources spent, while intensifying their efforts in the right direction. This structured approach helps

streamline the entrepreneurial process, providing a clear framework for decision-making under uncertainty. In Figure 9, the timeline presents two key tools: a table and a typology. The table, positioned on the left, assists entrepreneurs in selecting the most suitable startup methodology at the outset. As the timeline progresses to the right, representing the establishment of the enterprise, the typology becomes relevant, guiding decision-making in uncertain situations.

In summary, both research questions posed at the beginning of this study have been thoroughly addressed. The first question aimed to analyze the most popular entrepreneurial methods and determine which methodology best suits different types of business ideas. Through the discussion and the illustration provided in Figure 2, it is clear that selecting the appropriate methodology requires entrepreneurs to focus on two key factors: the initial conditions or "givens" at the start of their journey, and the desired effect or outcome they wish to achieve. Figure 2 serves as a valuable tool by allowing entrepreneurs to identify their position within one of its four quadrants, based on these givens and intended effects. This positioning helps guide them in choosing the most suitable methodology for their specific idea. By understanding their starting point and the impact they seek to create, entrepreneurs can make informed decisions about the approach that will best support their venture's success.

The second research question focused on understanding how the degree of newness, problem consensus, and solution knowledge interact to influence decision-making strategies for entrepreneurs navigating uncertainty. The developed typology, along with detailed explanations and examples, provides a clear illustration of how these three factors interact. The typology demonstrates the ways in which the interplay between newness, problem consensus, and solution knowledge can guide entrepreneurs in making informed decisions when faced with uncertain situations. By analyzing these interactions, the study offers valuable insights into how entrepreneurs can effectively manage uncertainty and make strategic choices that align with the unique challenges of their ventures.

Discussion:

One of the latest contributions to the Prediction Control (PC) matrix by Sarasvathy (2024) is in her article "*Lean Hypotheses and Effectual Commitments: An Integrative Framework Delineating the Methods of Science and Entrepreneurship"* where she uses the same 2 by 2 matrix to develop a CAVE framework consists of the four quadrants Causation, Adaptive, Visionary and Effectual. This framework is a versatile tool that maps various theories of strategic management and integrates a wide range of practical toolkits used in entrepreneurship education and training worldwide. These toolkits connect with key concepts from disciplines such as psychology, economics, history, and philosophy. Importantly, the framework distinguishes between the scientific method and the entrepreneurial method without oversimplifying the comparison.

This mapping done by Sarasvathy (2024) naturally highlights the relationship between science and entrepreneurship as connected yet distinct methods within the PC space. This article highlights that while there may be some justification for distinguishing between scientific and entrepreneurial methods, they have a complementary relationship, similar to yin and yang. This philosophical complementarity enables the effective use of both methods to navigate the PC space, emphasising the significance of their differences and interconnectedness.

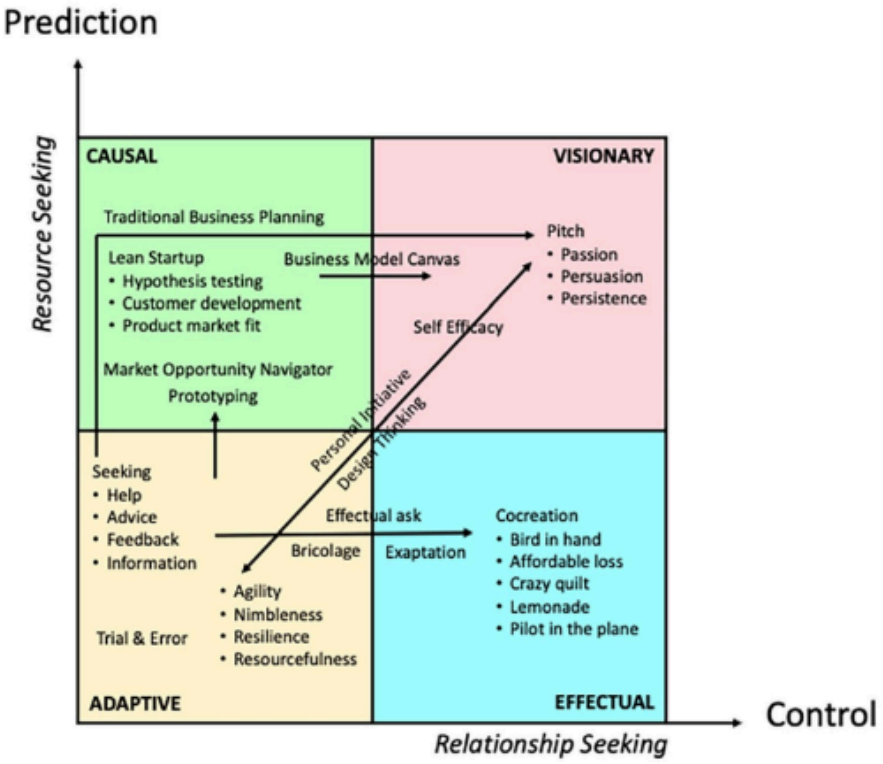


Figure 10: Techniques and Toolboxes in the CAVE Framework

In this framework Figure 10, Sarasvathy (2024) has placed agile in cell 3 and moving up to cell 1 there is a lean startup method as indicated in the diagram. This study is an improvement of her previous work in Wiltbank et al. (2006) and an attempt to combine the methods of Science and Entrepreneurship.

This framework diverges significantly from the one suggested in this study. In this thesis, the methods of entrepreneurship are organised within a unique structure, integrating two key models: the Prediction-Control (PC) matrix by Wiltbank et al. (2006) where the prediction and control are on the Y and X axis along with the Contingency Decision-Making Framework by Murphy et al. (2017) where the "problem consensus" and "solution knowledge" populate the axes. The innovative aspect of this framework lies in how these two matrices overlap, altering the interdependencies between the cells and shifting the dynamics of the model. The X-axis combines "emphasis on control" with "problem consensus," while the Y-axis merges "emphasis on prediction" with "solution knowledge." This overlapping of matrices transforms the original dynamics, offering a fresh perspective on how different entrepreneurial methods can be effectively applied.

For instance, in this integrated framework, it becomes logical to position lean methodology in cell 2 and agile methodology in cell 3 of Figure 8. This positioning is not a contradiction of the findings or logic presented in Sarasvathy (2024) but rather a contribution to theory. This contribution to the theory provides a more nuanced understanding of how entrepreneurial methods can be strategically applied depending on the specific context, thus advancing the discourse in entrepreneurial studies.

It is important to recognize that this table and typology are not definitive rules that must be followed to avoid failure; there are always exceptions in every field. While these tools are designed to assist new entrepreneurs in navigating uncertainty, they are not the only path to success. Experienced entrepreneurs often develop their own methods for managing uncertainty, and they may choose to follow or diverge from the strategies suggested here. In some cases, entrepreneurs may even adopt a hybrid approach to achieve their desired goals.

Limitation and future scope for research:

This study encountered several limitations that should be acknowledged to provide a clearer understanding of the findings and their context. These limitations highlight areas where further research and improvements in methodology could enhance the robustness and applicability of the results.

Generalization Challenges:

The primary limitation of this study is the difficulty in formulating a pattern that applies universally to all entrepreneurs due to the diverse backgrounds and unique circumstances of the participants. Generalizing findings from a limited set of interviews can be problematic, as the specific experiences and contexts of these entrepreneurs may not represent the broader entrepreneurial landscape. To propose a theory or roadmap that is widely applicable, more extensive field data must be gathered and the typologies need to be tested for each of them. This would help in validating the findings of this study.

Limited Access to Danish Entrepreneurs:

The research was confined to Danish entrepreneurs, which may not fully capture the diversity of entrepreneurial experiences in other regions or countries. The geographical limitation restricts the generalizability of the findings. Additionally, the time frame during which the

research was conducted, particularly during the summer vacation period, further limited access to potential participants. Many entrepreneurs were unavailable, reducing the sample size. The limited number of interviews conducted was a notable limitation of the methodology. Better time planning and the ability to gather more data could have allowed for the typology to be tested against multiple cases, thereby strengthening the argument for its applicability and validity. Despite this limitation, the collected data provided valuable insights that contributed to the development and testing of the typology.

Interviewing Experience and Questionnaire Design:

More detailed and extensive interviews would provide richer data, leading to more robust findings and a stronger theoretical framework. The author's lack of experience in conducting interviews and formulating questionnaires was another significant limitation. The quality of data collection is heavily influenced by the design of the interview questions and the skill of the interviewer. Better-designed questions could have elicited more detailed and useful responses, enhancing the quality of the data.

Sensitive Information and Data Gaps:

Some entrepreneurs were unable or unwilling to share certain sensitive information about their enterprises. This limitation restricted the depth of the data collected and affected the comprehensiveness of the analysis. Sensitive topics that are crucial for understanding the full scope of entrepreneurial decision-making were often left unexplored.

Personal Bias:

Personal bias is an inherent challenge in qualitative research. The same set of data can be interpreted differently by different researchers, leading to varying results and analyses. Although efforts were made to ensure objective interpretation, the potential for personal bias cannot be entirely eliminated. This bias means that the results might have been different if analyzed by another researcher, even with the same evidence from interviews.

In summary, this study's limitations highlight the need for further research with a larger, more diverse sample of entrepreneurs, improved timing for data collection, and more refined interviewing techniques. Addressing these limitations in future studies will help in

developing a more accurate and generalizable decision-making roadmap for entrepreneurs navigating uncertainties.

References

1. Christensen, C. M. (2006). The Ongoing Process of Building a Theory of Disruption. *Journal of Product Innovation Management*, *23*(1), 39–55. https://doi.org/10.1111/j.1540-5885.2005.00180.x
2. Conboy, K., & Fitzgerald, B. (2004). Toward a conceptual framework of agile methods: a study of agility in different disciplines. *Foundations of Software Engineering: Proceedings of the 2004 ACM Workshop on Interdisciplinary Software Engineering Research; 05-05 Nov. 2004*, 37–44. https://doi.org/10.1145/1029997.1030005
3. Courtney, H., Kirkland, J., & Viguerie, P. (1997). Strategy under uncertainty. In *Harvard business review* (Vol. 75, Number 6, pp. 66–79). Harvard Business School Publishing Corporation
4. Doty, D. H., & Glick, W. H. (1994). Typologies as a Unique Form of Theory Building: Toward Improved Understanding and Modeling. *The Academy of Management Review*, *19*(2), 230–251. https://doi.org/10.2307/258704
5. Foss, N. J., Klein, P. G., & Bjørnskov, C. (2019). The Context of Entrepreneurial Judgment: Organizations, Markets, and Institutions. *Journal of Management Studies*, *56*(6), 1197–1213. https://doi.org/10.1111/joms.12428
6. Knight, F. H. (1921). Risk, uncertainty and profit (Vol. 31). Houghton Mifflin
7. KOTTER, J. (1995). LEADING CHANGE - WHY TRANSFORMATION EFFORTS FAIL. In *Harvard business review* (Vol. 73, Issue 2, pp. 59–67). HARVARD BUSINESS REVIEW
8. McMullen, J. S., & Shepherd, D. A. (2006). Entrepreneurial Action and the Role of Uncertainty in the Theory of the Entrepreneur. *The Academy of Management Review*, *31*(1), 132–152. https://doi.org/10.5465/amr.2006.19379628
9. Milliken, F. J. (1987). Three Types of Perceived Uncertainty About the Environment: State, Effect, and Response Uncertainty. *The Academy of Management Review*, *12*(1), 133–143. https://doi.org/10.5465/amr.1987.4306502
10. Murphy, J., Willmott, H., & Daft, R. (2017). *Organisation Theory and Design* (Third edition.). Cengage

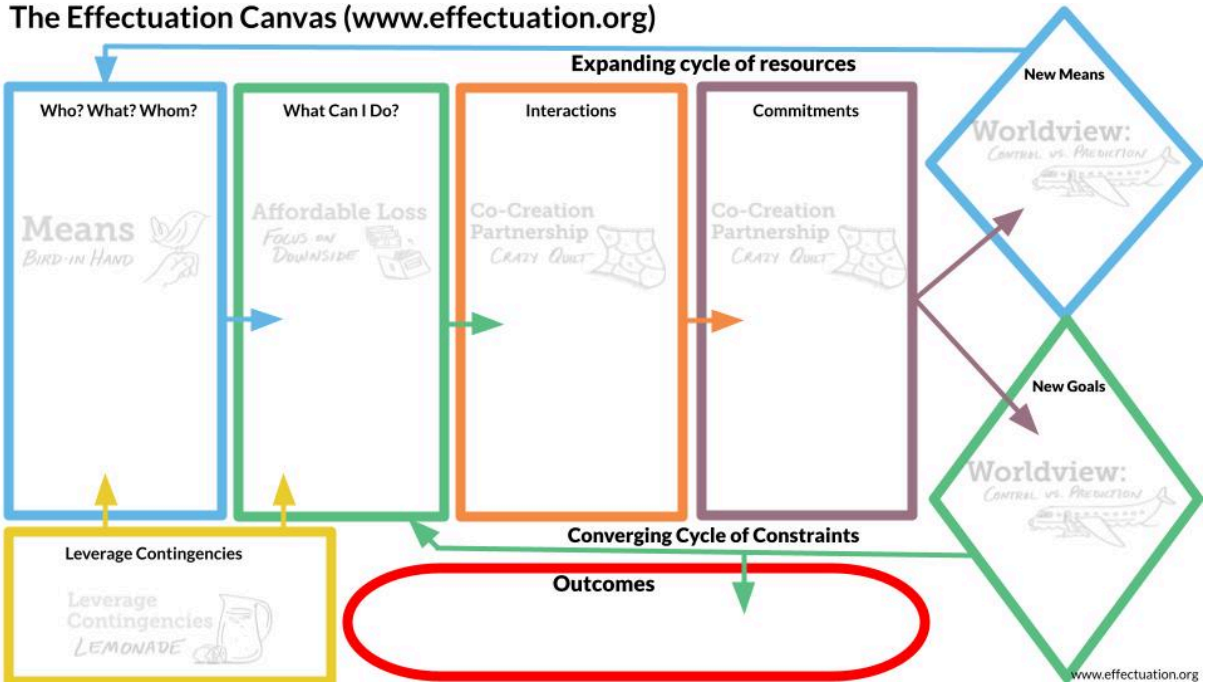
11. Owens, T., & Fernandez, O. (2014). *The Lean Enterprise: How Corporations Can Innovate Like Startups* (1st ed.). John Wiley & Sons, Incorporated. https://doi.org/10.1002/9781118854006
12. Packard, M. D., Clark, B. B., & Klein, P. G. (2017). Uncertainty Types and Transitions in the Entrepreneurial Process. *Organization Science*, *28*(5), 840–856. https://doi.org/10.1287/orsc.2017.1143
13. Sajdak, M. (2015). Theoretical and Practical Aspects of Developing Agile Enterprises. *International Journal of Management and Applied Research*. https://doi.org/10.18646/2056.24.15-015
14. Sarasvathy, S. D. (2001). Causation and Effectuation: Toward a Theoretical Shift from Economic Inevitability to Entrepreneurial Contingency. *The Academy of Management Review*, *26*(2), 243–263. https://doi.org/10.2307/259121
15. Sarasvathy, S. D. (2024). Lean Hypotheses and Effectual Commitments: An Integrative Framework Delineating the Methods of Science and Entrepreneurship. *Journal of Management*. https://doi.org/10.1177/01492063241236445
16. Taran, Y., Boer, H., & Nielsen, C. (2022). *The business model innovation process : preparation, organization and management*. Routledge
17. Townsend, David & Hunt, Richard & McMullen, Jeffery & Sarasvathy, Saras. (2018). Uncertainty, Knowledge Problems, and Entrepreneurial Action. Academy of Management Annals. 12. 10.5465/annals.2016.0109
18. Wang, C., Dai, M., Fang, Y., & Liu, C. (2022). Ideas and methods of lean and agile startup in the VUCA Era. *International Entrepreneurship and Management Journal*, *18*(4), 1527–1544. https://doi.org/10.1007/s11365-022-00797-3
19. Wiltbank, R., Dew, N., Read, S., & Sarasvathy, S. D. (2006). What to do next? The case for non-predictive strategy. *Strategic Management Journal*, *27*(10), 981–998. https://doi.org/10.1002/smj.555
20. Yariv Taran, & Harry Boer. (2013). *Towards a typological theory of business model innovation processes*. Continuous Innovation Network.

Appendix

Questionnaire for interview

Part -1

To understand the basic information about the entrepreneur as a question using the effectuation canvas to understand if the entrepreneur used effectuation as a process of creating a new venture



In the end, ask them if they are aware of the effectual process.

1. Can you share the story of how your journey into entrepreneurship began? What sparked your interest in starting your own business, and what were the initial steps you took to bring your ideas to life?
2. Reflecting on your entrepreneurial journey, could you elaborate on the period when you first entered the business world? How did you navigate the early stages of establishing your business, and what age were you at that time?

3. How do you believe your nationality has influenced your entrepreneurial mindset and approach to business? Are there any cultural or societal factors that have shaped your entrepreneurial journey?
4. How did you initially engage in collaborative efforts or partnerships when you started your business? Can you provide examples of these collaborations and their impact on your venture's early development?
5. What drove you to explore collaborative opportunities in the early stages of your entrepreneurial journey?
6. Share a specific instance of a successful collaboration that significantly influenced your business's growth or development. What do you think contributed to its success?
7. Reflecting on your experience, how did you discover potential collaborators or partners for your business ventures? Were there particular methods or approaches you found effective in identifying them?
8. What challenges or hurdles did you encounter while establishing collaborative relationships? How did you navigate through these obstacles?
9. How do you assess the potential advantages and disadvantages of collaborating with others in your business endeavours? What factors guide your decision-making process regarding collaborative opportunities?
10. Within which industries do you operate, and what drew you to these particular sectors? Can you describe the journey that led you to become involved in these industries?
11. Tell me about your educational background and how it has contributed to your entrepreneurial endeavours. In what ways have your academic experiences influenced your approach to business?
12. Providing some context about your economic background, how do you think it has impacted your journey as an entrepreneur? Were there any financial challenges or opportunities that significantly shaped your path in business?
13. Considering the role of age and experience in entrepreneurship, how do you perceive their influence on your journey? How has your age impacted your perspective and decision-making as an entrepreneur?

Part -2

Research Question 1: What are the primary sources of uncertainty that entrepreneurs encounter in their business endeavours?

General Understanding:

1. Can you describe a recent experience where you felt uncertain about the direction of your business? What were the primary factors contributing to this uncertainty?
2. In your opinion, what are the main sources of uncertainty that entrepreneurs typically encounter in the Danish business landscape?

Industry/Market Specific:

3. Can you provide examples of external factors that have caused uncertainty in your industry in the past?
4. Could you provide examples of industry-specific factors that commonly contribute to uncertainty for entrepreneurs in Denmark?

Impact and Management:

5. How does uncertainty affect your decision-making process as an entrepreneur?
6. What strategies or methods do you employ to manage or mitigate uncertainty in your business endeavours?

Research Question 2: How do entrepreneurs perceive and define uncertainty within their respective industries or markets?

Personal Perception:

1. Looking back on your entrepreneurial experience, can you discuss some of the most significant hurdles you encountered during the early stages of your business? How did you navigate these challenges?
2. How do you personally define uncertainty in the context of your business?
3. Do you believe uncertainty is an inherent aspect of entrepreneurship, or is it more prevalent in certain industries?

External Influences:

4. How do factors such as regulatory changes or economic fluctuations contribute to uncertainty within your industry?
5. Have you observed any shifts in how uncertainty is perceived within your industry over the past few years?

Research Question 3: How do entrepreneurs make decisions when faced with uncertainty (assess and prioritize different options or strategies)?

Decision-Making Process:

1. Can you walk me through your decision-making process when faced with a situation of uncertainty?
2. How do you assess and prioritize different options or strategies during uncertain times?

Risk Tolerance:

3. To what extent does your risk tolerance influence your decision-making in uncertain situations?
4. Have you ever made a decision under uncertainty that didn't yield the expected outcome? How did you adapt?

Learning and Adaptation:

5. How do you incorporate lessons learned from past experiences of uncertainty into your decision-making process?
6. Can you provide an example of a successful decision you made under uncertainty, and how it contributed to your business's growth?